INDEX
K.S.A. 82a-301 to 305a
Division of Water Resources
Kansas Department of Agriculture
Effective May 18, 2007

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K.A.R. 5-40-1. Definitions. As used in K.S.A. 82a-301 through 82a-305a and amendments thereto, in the regulations adopted pursuant to these statutes, and by the chief engineer in administering K.S.A. 82a-301 through 82a-305a and amendments thereto, the following terms shall have the meanings ascribed to them in this regulation, unless the context clearly requires otherwise:

(a) "Application" means the formal document and any required supporting information that are submitted to the chief engineer and request a permit, pursuant to K.S.A. 82a-301 through 82a-305a, and amendments thereto.

(b) "Appurtenant works" means the primary spillway and other conduits through a dam, the valves, the auxiliary spillway, the service spillway, the stilling basin, any constructed outlet channel, all dikes and berms designed and constructed to protect the dam, the drains, and all other features constructed to protect or operate a dam.

(c) "As-built drawings" means the drawings showing a permitted project and all appurtenant works as the project and works were actually built. This term shall include the following:

(1) All deviations from the plans that were approved by the chief engineer;

(2) the location and design of any instruments and monitoring equipment that were installed at the site;

(3) the location and elevation of any benchmarks; and

(4) a certification that the permitted project was constructed as shown on the as-built drawings.

(d) "Authorized representative" means any employee of the chief engineer designated by the chief engineer to perform duties and functions on behalf of the chief engineer.

(e) "Auxiliary spillway" means an open channel that is constructed over or around an embankment for the purpose of conveying safely past the dam the flows that are greater than the primary spillway design discharge and that can be stored in the detention storage. This term is also known as an emergency spillway.

(f) "Benchmark" means a reference point or object of known elevation and location that is not expected to move horizontally or vertically during the life of the project.

(g) "Borrow area" means land, usually located near the dam, from which earth used to construct the embankment will be excavated.

(h) "Breach analysis" means an engineering analysis to determine the areas that would be inundated if a dam failed.

(i) "Channel change" means any project that alters the course, current, or cross section of any stream.

(j) "Chief engineer" means the chief engineer, division of water resources of the Kansas department of agriculture.

(k) "Control section" means the immediate downstream end of the level section of an open-channel earthen spillway. The elevation of the control section is the elevation of the open-channel spillway crest.

(l) "Cutoff collar" means a projecting flange built or installed completely around the outside of a pipe to lengthen the path of seepage along the outer surface of the pipe.

(m) "Cutoff trench" means an excavation under a dam to be later filled with impervious material to prevent or reduce the seepage of water through the foundation of a dam.

(n) "Design discharge" means the maximum rate of flow, expressed in cubic feet per second, released from a dam's spillways for the design storm.

(o) "Design storm" means the precipitation event specified in K.A.R. 5-40-22 that is the minimum precipitation event required to be used to design a particular dam.

(p) "Detention storage" means the volume in the reservoir between the lowest uncontrolled spillway, not including any low-flow augmentation works, and the crest of the auxiliary spillway.

(q) "Detention storm" means the storm described in K.A.R. 5-40-23.

(r) "Easily erodible soils" means soils with a high content of fine sand or silt and with little or no cohesion or plasticity, including fine sand, silt, sandy loam, and silty loam.

(s) "Effective height" means the difference in elevation between the crest of an auxiliary spillway or service spillway and the lowest point of the downstream toe of a dam. If the dam does not have an auxiliary or service spillway, the effective height means the difference in elevation between the top of the dam and the lowest point of the downstream toe of the dam.

(t) "Effective storage" means the volume of storage space in a reservoir below the crest of the auxiliary spillway or service spillway and above the elevation of the downstream toe of the dam at its lowest point. Effective storage shall not be reduced by accounting for accumulated sediment.

(u) "Embankment" means the earthen-fill portion of the dam.

(v) "Emergency action plan" means a formal document that identifies potential emergency conditions at a dam and specifies preplanned actions to be followed to minimize property damage and loss of life if the dam fails.

(w) "Erosion-resistant soils" means cohesive soils with a high clay content and high plasticity, including silty clay, sandy clay, and clay.

(x) "Freeboard" means the vertical distance between the maximum water surface elevation attained during the design storm and the top of the dam.

(y) "General plan" means a plan adopted by a watershed district, drainage district, or similar entity required by statute to be approved by the chief engineer, including any of the plans formulated under K.S.A. 24-901 and K.S.A. 24-1213, and amendments thereto.

(z) "Hazard" means the property or people that could be damaged or endangered by the failure of a dam, including people or property that might be inundated. This term shall include a public or industrial water supply stored in the reservoir created by the dam that would be released if the dam failed.

(aa) "High-impact dams" means all of the following classes of dams:

(1) Size class 4, hazard class A dams;

(2) size classes 3 and 4, hazard class B dams; and

(3) all hazard class C dams, using the definitions of hazard class and size class in K.A.R. 5-40-20 and K.A.R. 5-40-21.

(bb) "Hydraulically most distant point in the watershed" means the point in a watershed from which a raindrop falling at that point takes the longest time to reach the dam.

(cc) "Impervious material" means material that allows a relatively low rate of water movement through its cross section.

(dd) "Inspection year" means the period on and after May 1 of one year through April 30 of the following year. The inspection year shall be named for the calendar year in which the inspection year ends.

(ee) "Inundation area" means the area below a dam that will be inundated with water as determined by conducting a breach analysis meeting the requirements specified in K.A.R. 5-40-24.

(ff) "Invert" means the lowest point on the inside of the outlet of a conduit.

(gg) “Low-flow augmentation works” means any uncontrolled conduit, orifice, or other appurtenant works that slowly release water from storage in a reservoir, or bypass low flow through a reservoir.

(hh) “Low-impact dams” means all of the following classes of dams:

(1) Size classes 1, 2, and 3, hazard class A dams; and

(2) size classes 1 and 2, hazard class B dams, using the definitions of hazard class and size class in K.A.R. 5-40-20 and K.A.R. 5-40-21.

(ii) “Maintenance” means the actions or upkeep performed on a dam or its appurtenances to compensate for wear and tear on the dam and appurtenances and to preserve the dam and appurtenances so that the dam and appurtenances function properly until they are removed, including woody vegetation control; grass seeding; burrowing animal control; repair of minor erosion, cracks, animal burrows, and minor settling; care of pipes, piezometers, drains, valves, gates, and other mechanical devices; replenishment of riprap; and removal of debris from spillways.

(jj) “Modification” means any change in a dam or its appurtenances that involves a change to or significant disturbance of the embankment, an alteration of the flow characteristics of a spillway, a change in the storage capacity or freeboard, or any other significant alteration in the functioning of the dam.

(kk) "Navigable stream" means any of the following:

(1) The Arkansas river;

(2) The Missouri river; or

(3) The Kansas river.

(ll) “One percent-chance storm” means a rainfall event that has a one percent chance of being equaled or exceeded one or more times in a year.

(mm) “Owner of a dam” means the owner or owners of the land upon which a dam and appurtenant works are constructed unless an easement authorizes another person or entity to construct and maintain a dam on that easement. With such an easement, the holder of the easement shall be considered to be the owner of the dam.

(nn) "Perennial stream" means a stream, or part of a stream, that flows continuously during all of the calendar year, except during an extreme drought.

(oo) “Permanent pool” means the storage space in a reservoir below the elevation of the lowest uncontrolled spillway, not including any low-flow augmentation works. This term is also known as the “normal pool.”

(pp) "Permit" means the consent or other formal document issued by the chief engineer that authorizes the construction, repair, or modification of a dam, channel change, or stream obstruction, and its operation and maintenance.

(qq) "PMP" means the probable maximum precipitation that can occur in a precipitation event as prescribed by K.A.R. 5-40-31.

(rr) "Prejurisdictional dam" means any of the following:

(1) A dam constructed before May 28, 1929;

(2) a dam constructed by an agency or political subdivision of state government, other than a county, city, town, or township, before April 11, 1978; or

(3) a dam constructed before July 1, 2002 that is 25 or more feet in height and impounds less than 30 acre-feet of water at the top of the dam.

(ss) "Primary spillway" means the uncontrolled outlet device through a dam that provides the initial outlet for storm flows, usually consisting of either of the following:

(1) A riser structure in combination with an outlet conduit; or

(2) a canopy or hooded inlet structure in combination with an outlet conduit.

This term is also known as a "principal spillway."

(tt) "Rainfall excess" means that part of the rain in a given storm that falls at intensities exceeding the infiltration capacity of the land and that is the volume of the rain available for direct runoff.

(uu) "Reservoir" means the area upstream from a dam that contains, or can contain, impounded water.

(vv) "Repair" means any action, other than maintenance, taken to restore a dam and its appurtenant works to their original permitted condition.

(ww) "Service spillway" means an open-channel spillway constructed over or around a dam embankment to convey safely past the dam all flows entering the reservoir that cannot be stored in the reservoir behind a dam that does not have a primary spillway.

(xx) "Size factor" means the effective height of the dam, expressed in feet, multiplied by the effective storage of the reservoir, expressed in acre-feet.

(yy) "Stilling basin" means an open structure or excavation at the outlet of a spillway that dissipates the energy of fast-moving water being discharged from the spillway to protect the streambed below a dam from erosion.

(zz) "Stream" means any watercourse that has a well-defined bed and well-defined banks and that has a watershed above the point marking the site of the project that exceeds the following number of acres in the zones specified:

(1) Zone three: 640 acres for all geographic points within any county west of a line formed by the adjoining eastern boundaries of Phillips, Rooks, Ellis, Rush, Pawnee, Edwards, Kiowa, and Comanche counties;

(2) Zone two: 320 acres for all geographic points within any county located east of zone three and west of a line formed by the adjoining eastern boundaries of Republic, Cloud, Ottawa, Saline, McPherson, Reno, Kingman, and Harper counties; and

(3) Zone one: 240 acres for all geographic points within any county located east of zone two.

The flow of a stream is not necessarily continuous and can occur only briefly after a rain in the watershed. If the site of the project has been altered so that a determination of whether the well-defined bed and banks did exist is not possible, it shall be presumed that the bed and banks did exist if the watershed acreage criteria specified in this subsection have been met, unless the owner of the project conclusively demonstrates that the well-defined bed and banks did not exist when the project site was in its natural state and had not been altered by human activity.

(aaa) "Stream obstruction" means any project or structure that is wholly or partially placed or constructed in a stream and that does not meet the definition of a dam in K.S.A. 82a-301 and amendments thereto.

(bbb) "Time of concentration" means the time required for runoff to flow from the hydraulically most distant point in the watershed to the watershed outlet once the soil has become saturated and minor depressions have been filled.

(ccc) "Trash rack" means a protective device installed on the inlet of a primary spillway to prevent trash and other debris from obstructing the primary spillway without obstructing the flow of water.

(ddd) "Watershed" means all of the area draining toward a selected point on a stream.

(eee) "Wing dike" means an earthen or rock structure below the toe of a dam that is constructed to protect the embankment from erosion.

(fff) "Zone," in an earthen dam, means a segment of earthen fill containing similar materials.

(ggg) "Zoned fill" means an embankment divided into two or more zones to make the best use of available materials. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 1, 1983; amended May 1, 1987; amended, T-5-12-30-91, Dec. 30, 1991; amended Feb. 17, 1992; amended Sept. 22, 2000; amended May 18, 2007.)

K.A.R. 5-40-2. Dams; plans and specifications. The plans required by K.S.A. 82a-302, and amendments thereto, to construct, repair, or modify a dam shall include sufficient views to show all features in three dimensions and in sufficient detail to instruct a competent contractor to construct, repair, or modify the dam by viewing the plans and specifications. All plans with multiple pages shall include an index describing the location of required views within the plans. The views and maps specified in this regulation shall be shown. Specific details shall be listed under the view that is typically most appropriate, but they may be displayed on another view to improve the legibility of the plans if sufficient detail is provided in the plans to describe each feature in three dimensions. The required plans shall include the following:

(a) Plan views of the dam and dam site, which shall include both abutments of the dam, the area downstream to the point where the auxiliary spillway or service spillway flows enter the receiving channel, and the area upstream of the upstream toe of the dam to where the borrow area will be permitted. All elevations shown on plans shall be referenced to the same datum as the benchmarks described on the plans. The following details shall be shown, if applicable:

(1) The location of the axis of the dam, showing stationing and top width limits;
(2) the toe of the upstream and downstream slopes;
(3) the location of the centerline and the limits of each open-channel spillway;
(4) the location of the primary spillway and any stilling basin;
(5) the location of each berm;
(6) the location of slope protection;
(7) the location of borings, test holes, and test pits;
(8) the location of intakes, outlets, valves, and valve wells;
(9) the location, description, and elevation of each benchmark;
(10) the location, description, and details of all foundation drains;
(11) the location and limits of each borrow area; and
(12) the location and topography of the area where the auxiliary spillway discharge returns to the receiving stream;

(b) a map of the drainage pattern above and below the dam site drawn to an appropriate scale. The map shall show the following:

(1) The location of the watercourse across which the dam is to be built and the point where the centerline of the dam crosses the centerline of the stream specified in latitude and longitude, or in feet north and west of the southeast corner of the section;
(2) the location of the dam and the outline of the reservoir;
(3) the boundary of the watershed, shown by a line enclosing the entire area that Will drain into the reservoir;
(4) section lines, with sections properly identified; and
(5) the size of the drainage area in acres or square miles;

(c) a topographic map of the dam site and reservoir area, which shall be shown to a scale that provides sufficient detail to clearly show the required features and to locate them in the field, but in no case is less than 1 to 3,600. The elevation of each contour shall be clearly noted on the map. The following details shall be shown:

(1) The location of the dam; and

(2) the following topography:

(A) The contours at two-foot intervals. For dams more than 20 feet in height, contours may be spaced at greater intervals, but the interval shall not exceed four feet;

(B) the contour equivalent to the elevation of the lowest uncontrolled spillway inlet, not including any low-flow augmentation works;

(C) the contour equivalent to the maximum water surface reached during the design storm;

(D) the contour equivalent to the elevation of the top of the dam;

(E) construction ingress and egress routes to the dam and reservoir;

(F) the name and address of each person owning any of the following:

(i) The land on which the dam and its appurtenances, including the auxiliary spillway or service spillway, down to the location where the spillway discharges back to the receiving stream, will be constructed;

(ii) ingress and egress routes to the dam and reservoir;

(iii) the reservoir site up to the top of the dam elevation; and

(iv) the borrow areas if they are located outside the reservoir site;

(G) if the reservoir area is divided between more than one landowner, the property lines, which shall be shown on the topographic map of the reservoir;

(H) roads, railroads, pipeline crossings, and any other prominent features in the vicinity;

(I) the boundary line for each easement; and

(J) the limits of each borrow area;

(d) the cross-section view of the valley at the dam site, which shall be shown along the centerline of the dam with the same stationing as that used on the plan view. The following shall be shown:

(1) The elevation to which the top of the dam is to be maintained and the elevation to which the dam is to be initially constructed in order to provide an adequate settlement allowance;

(2) the location and elevation of the auxiliary spillway or service spillway at the centerline of the dam;

(3) the original surface of the ground, including the streambed, up to the elevation of the top of the dam;

(4) the proposed elevations of the bottom of the cutoff trench; and

(5) the location of all test holes and the materials encountered in the test holes;

(e) a cross-section view perpendicular to the centerline of the dam at the lowest point on the downstream toe extending to the limits of the fill being placed. If the cross section is variable, a typical section shall be shown for each reach of similar cross section with a proper description of the reach by stationing. Additional typical cross sections along the centerline of the primary spillway and the centerline of any other outlets shall be shown. Cross sections of the dam shall include the following:

(1) The elevations of the shoulders and centerline of the dam and the width of the top of the dam;

(2) the elevation of the top of any berm, the elevation of the outside shoulder of any berm, and the top width of any berm;

(3) the slopes of upstream and downstream faces of the dam;

(4) the elevation, location, and type of slope protection;

(5) the zones of the embankment;

(6) the dimensions to which the dam is to be constructed to provide an adequate allowance for settlement;

(7) the elevation, location, and dimensions of the planned cutoff trench; and

(8) the elevation of the downstream toe of the dam at its lowest point;

(f) the following information concerning each open-channel spillway:

(1) A plan view showing the location and stationing along the centerline of the spillway, together with the location of the control section;

(2) cross sections showing side slopes and dimensions of the spillway, and the original surface of the ground up to the point where the spillway sides intersect the original ground surface;

(3) a profile along the centerline of the spillway, extending from the point upstream where the profile of the spillway intersects natural ground through the control section to the streambed below the dam. The stationing on the profile shall correspond to that on the plan view. The station and elevation of the breaks in the grade of the spillway shall be shown. This profile shall show the existing ground elevation, proposed grade of the bottom of the spillway, elevation of slope protection on the side slopes, and geologic logs of the borings required in the auxiliary spillway or service spillway by K.A.R. 5-40-40, superimposed on the profile through which the spillway is excavated; and

(4) the data necessary to stake out any curves;

(g) the following information concerning the primary spillway:

(1) The profile along the centerline of the spillway, extending from the intake to the outlet, showing the size, dimensions, and locations of seepage control features. This profile shall show existing ground elevations and the proposed grade of the spillway;

(2) the plan, profile, and cross-section views of the stilling basin, primary spillway supports, and other features;

(3) the geologic logs of the borings done in the vicinity of the primary spillway shall be superimposed on the profile;

(4) the location and type of all bedding materials;

(5) a table of pipe grades for all concrete pipes; and

(6) conduit joint details;

(h) the number of acres enclosed by each contour within the reservoir area and the total storage capacity of the reservoir in acre-feet at the elevation of each contour, which shall be determined and tabulated on the plan. The data shall be compiled for all contours in the reservoir up to the elevation of the top of the dam. Computations of capacity shall be based on the natural topography of the reservoir basin but may include the volume of any excavation in the reservoir made during construction of the dam;

(i) a curve or table showing the discharge capacities, in cubic feet per second, of all spillways through a range of surface water elevations from the lowest spillway inlet elevation to the top of the dam elevation, which shall be developed and shown on the plans or in the design report;

(j) the following information, which shall be shown on the plans in plan view, profile, and cross section:

(1) Drain details, including foundation drains;

(2) permanent erosion control protection, including riprap; and

(3) details of stilling basins, outlets, and other appurtenant structures; and

(k) the following information, which shall be shown on either the plans or the specifications:

(1) A table of gradation for each drain; and

(2) a table of gradation of the bedding of the riprap. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 1, 1983; amended May 1, 1985; amended May 1, 1987; amended May 18, 2007.)

K.A.R. 5-40-2a. Benchmarks.

(a) At least two permanent benchmarks shall be installed for future reference at each dam. Each benchmark shall be located according to the following criteria:

(1) In an area where the benchmark will not be disturbed, destroyed, or inundated after the dam is complete; and

(2) Along the centerline of the dam on either end of the dam, if practical, and in undisturbed soil.

(b) On high-impact dams, each permanent benchmark shall also meet the following criteria:

(1) Be installed in a hole that meets the following criteria:

(A) Is 12 inches in diameter; and

(B) is at least 42 inches deep or is drilled to bedrock, whichever is less;

(2) be constructed of one or more steel reinforcing bars at least 3/8 inch in diameter and 36 inches in length or the length of the depth of the hole, whichever is less. The reinforcing bar or bars shall be placed in the hole and the hole backfilled with concrete rounded off flush with the ground;

(3) be capped by a metal survey marker; and

(4) be either marked by a witness post or survey marker sign or tied to at least two objects in the vicinity by distance and bearing.

(c) On low-impact dams, each permanent benchmark shall also meet the following minimum requirements:

(1) Be constructed of a reinforcing bar that is 36 inches long, one-half inch in diameter, and driven flush with the surface of the ground;

(2) be installed at a location protected from grazing animals and vehicular traffic; and

(3) be either marked by a witness post or survey marker sign or tied to at least two objects in the vicinity by distance and bearing.

(d)(1) The elevation and horizontal location of each permanent benchmark shall be shown on the as-built drawings or the construction inspection report. The location of each permanent benchmark shall be described in reference to centerline stationing and offset from the centerline. The elevation of each permanent benchmark for all of the following classes of dams shall be referenced to the national geodetic vertical datum of 1988, or other acceptable national vertical datum, to a tolerance of plus or minus 0.5 foot:

(A) Class size two, hazard classes B and C;

(B) class size three dams; and

(C) class size four dams.

(2) The elevation of each benchmark for class sizes one and two, hazard class A dams may be referenced to an assumed datum.

(e) Horizontal control shall be referenced to the Kansas state plane coordinate system as set forth in K.S.A. 58-20a01 et seq., and amendments thereto. The location of each benchmark shall be shown on the as-built drawings or the notice of completion by using either of the following:

(1) The plane coordinate values consisting of a northing and an easting from the appropriate monumented point according to K.S.A. 58-20a03, and amendments thereto; or

(2) the feet distances north or south, and east or west, from the nearest or most convenient section corner. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-2b. Design reports.

(a) The application for each permit to construct, repair, or modify a dam shall be accompanied by a design report prepared by the engineer who designed the new dam or the repair or modification of an existing dam. The design report shall document every major design element of the dam, the conditions that must be addressed in the construction of the project, and the manner in which those conditions will be addressed. The design report shall document the design process, including references to each design method and computer program utilized in the design, and shall include the following:

(1) The design of any slope protection for the embankment and the auxiliary or service spillway. If no slope protection is provided, the report shall provide justification for not having slope protection;

(2) documentation of the determination of the hazard class;

(3) a report of the geotechnical investigation, including the results of the testing required in K.A.R. 5-40-40 through K.A.R. 5-40-42, and all boring logs not shown on the plans;

(4) documentation of the embankment design based upon the geotechnical investigation;

(5) documentation of the hydrological evaluation, including the determination of the composite curve number and drainage area;

(6) if a proposed dam is part of a general plan, the report shall evaluate whether the proposed dam conforms to the general plan;

(7) the design of the foundations, including the proposed depth of the cutoff trench;

(8) the design of the drains, including size, material gradation, interface with soil, and outlets;

(9) the design of the pipe bedding, including documentation that the loading and deflection conditions are met;

(10) the stilling basin design;

(11) documentation of the flood routing or routings;

(12) the gradation of the material in the diaphragm and the design of the diaphragm; and

(13) any other relevant information required by the chief engineer.

(b) In addition to those items required in subsection (a), the design report for each high-impact dam shall include the following:

(1) The auxiliary spillway or service spillway analysis required by K.A.R. 5-40-56(c), if applicable, or K.A.R. 5-40-57(a);

(2) a slope stability analysis; and

(3) an embankment settlement analysis. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-3. Specifications.

(a) Each applicant shall submit specifications with the application for a permit to construct a dam. The specifications shall address every major element in the construction of the dam and the materials used to construct the dam. The specifications shall be clear, legible, and sufficiently detailed to ensure that the dam and appurtenant works will be properly constructed and shall meet the requirements of sound engineering principles and commonly accepted engineering practices. The specifications shall state the minimum quality of materials and workmanship that is acceptable and the required materials tests and testing frequency. The specifications shall cover the following:

(1) The excavation procedures;

(2) the placement and compaction of earthen fill;

(3) the dewatering process;

(4) concrete and reinforcing steel requirements and placement;

(5) the materials for and placement of all conduits;

(6) the materials for and placement of permanent erosion control measures;

(7) drains and seepage control, including aggregate requirements; and

(8) seeding and fencing.

The specifications shall also include an index. The specifications may be submitted electronically in a form and manner prescribed by the chief engineer.

(b) A copy of the plans and specifications that have been approved by the chief engineer shall be accessible at the construction site at all times during construction.

(Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 1, 1983; amended May 1, 1987; amended May 18, 2007.)

K.A.R. 5-40-4. Preparer of maps, plans, profiles, reports, and specifications. In addition to the requirements of the Kansas state board of technical professions, the requirements in this regulation shall apply.

(a) Each map, plan, profile, report, and specification submitted to the chief engineer for approval shall be prepared by, or under the supervision of, a person who is competent in the design and construction of channel changes~~,~~ or stream obstructions, as appropriate.

(b) Maps, plans, profiles, reports, and specifications for any dam shall be prepared by, or under the supervision of, a licensed professional engineer who is competent in the design and construction of dams:

(c) Maps, plans, profiles, reports, and specifications for any channel change or stream obstruction project on a navigable stream or a stream having a mean annual flow of 100 cubic feet per second or more at the proposed location of the project shall be prepared by a licensed professional engineer who is competent in the design of that type of project.

(d) No provision of this regulation, and no decision made by the chief engineer pursuant to this regulation, shall alter the responsibilities or duties of any licensee of the Kansas state board of technical professions to comply with that board's requirements. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 1, 1983; amended May 1, 1986; amended May 1, 1987; amended Sept. 22, 2000; amended May 18, 2007.)

K.A.R. 5-40-5. Determining the capacity of a reservoir.

(a) The capacity of each proposed reservoir shall be determined as specified in K.A.R. 5-40-2(h).

(b) The capacity of each existing reservoir shall be determined by using the procedure specified in K.A.R. 5-40-2(h) for contours above the water surface. The engineer determining the reservoir capacity shall demonstrate the validity of the method that the engineer selects to extrapolate the data for contours below the water surface. The capacity of an existing reservoir shall not be reduced by including the accumulated sediment. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301 and 82a-303a; effective May 1, 1983; amended May 18, 2007.)

K.A.R 5-40-5a. Determining the height of a dam or barrier. To determine the height of a dam or barrier pursuant to K.S.A. 82a-301(b) and amendments thereto, that measurement shall be made as follows:

(a) The height of a dam or barrier that extends across the natural bed of a stream or watercourse shall be the vertical distance measured from the bed of the stream or watercourse at the downstream toe of the dam or barrier to the lowest elevation on the top of the dam or barrier, excluding any open-channel spillway and any anomalous low points.

(b) The height of a dam or barrier that does not extend across the natural bed of a stream or watercourse shall be the vertical distance measured from the lowest elevation of the outside limit of the dam or barrier to the lowest elevation on the top of the dam or barrier, excluding any open-channel spillway and any anomalous low points.

(c) The height of a proposed barrier or dam shall be measured from the planned top of the dam, excluding any allowance for settlement. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301 and 82a-303a; effective May 18, 2007.)

K.A.R 5-40-6. Waiver and stricter requirements.

(a) The chief engineer may waive any of the regulations adopted under articles 40, 41, 42 and 43 if it is shown to the satisfaction of the chief engineer that the waiver of the regulation will not pose a hazard to the public safety and that the waiver is in the public interest.

(b) The chief engineer may also invoke any jurisdiction granted by statute and impose stricter requirements than required by rules and regulations where such jurisdiction or additional requirements are necessary to protect the public interest, protect the public safety or prevent damage to property. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1983; amended May 1, 1987.)

K.A.R 5-40-7. Other maps, plans, profiles, data and specifications. The applicant shall also submit any other maps, plans, profiles and specifications of the dam, channel change or obstruction and any other data which the chief engineer may require. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1983; amended May 1, 1987.)

K.A.R. 5-40-8. Acceptable application.

(a) To be acceptable for filing, each application for a permit to construct, modify, or repair a dam, other stream obstruction, or channel change shall be accompanied by the statutorily required filing fee and shall contain all of the following:

(1) One copy of the completed application on a form prescribed by the chief engineer and signed by the applicant;

(2) two copies of the maps, plans, specifications, and profiles for a proposed or existing dam that meet the requirements of these regulations or one copy of the maps, plans, specifications, and profiles for any other stream obstruction or channel change that meet the requirements of these regulations; and

(3) for a proposed or existing dam, one copy of the design report that meets the requirements of these regulations.

(b) If the applicant fails to meet the requirements of subsection (a), the applicant shall be notified by the chief engineer of the deficiencies in writing and given 60 days from the time the notice is postmarked to submit the required items. If the required items are not submitted within 30 days after the chief engineer's notice is postmarked, a reminder letter shall be sent to applicant again requesting the required items.

(c) Any applicant may submit a request for an extension of time to provide a complete application. The applicant shall submit the request for extension of time before the deadline to submit the items. The request shall also include a justification for the extension of time and an estimate of the time needed to submit the required items.

(d) If the required items are not submitted within 60 days after the chief engineer's notification of deficiency, or within any authorized extension of time, the application shall be dismissed and the application fee forfeited.

(e) If the dismissed application was for the construction, repair, or modification of an existing illegal, unpermitted dam, the removal of the dam shall be ordered by the chief engineer.

(f) If an application is dismissed pursuant to this regulation, within 30 days of the date of dismissal the applicant may apply to have the application reinstated. The application may be reinstated by the chief engineer for good cause shown by the applicant. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301, 82a-302, and 82a-303a and K.S.A. 82a-303c; effective May 1, 1983; amended May 18, 2007.)

K.A.R. 5-40-9. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1983; amended May 1, 1985; amended May 1, 1986; revoked May 18, 2007.)

K.A.R. 5-40-10. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1984; amended May 1, 1985; amended May 1, 1986; revoked May 18, 2007.)

K.A.R. 5-40-11. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302 and 82a-303; effective Sept. 22, 2000; revoked May 18, 2007.)

K.A.R. 5-40-12. As-built drawings.

(a) Each permit shall be conditioned by the chief engineer to require as-built drawings for each category listed in subsection (b) to be submitted within 90 days of the completion of the dam, repairs, or modifications, or any extension of time authorized by the chief engineer for good cause. The drawings shall be prepared by a person qualified to prepare the original plans and specifications pursuant to K.A.R. 5-40-4.

(b) As-built drawings shall be submitted for each of the following categories:

(1) All high-impact dams;

(2) any dam, if required by the chief engineer as a condition of the permit to build, repair, or modify the dam; and

(3) any dam, if required by the chief engineer as the result of an approval of a change in the approved plans requested by the applicant during construction.

(c) The as-built drawings shall show all the features of the structure included in the approved plans as those features were constructed. A legibly marked-up copy of the approved plans shall be acceptable as as-built drawings.

(d) A profile of the bottom of the cutoff trench as constructed shall be shown on the as-built drawings. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 82a-303 and 82a-303a; effective May 1, 1987; amended May 18, 2007.)

K.A.R. 5-40-13. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987; revoked May 18, 2007.)

K.A.R. 5-40-14. Testing a principal spillway pipe installation in a dam; applicability.

(a) For the purpose of testing the leakage rate of principal spillway pipe installation in a dam, an applicant shall conduct a static pressure test of each principal spillway installation constructed of corrugated metal pipe.

(b) A static pressure test shall be required only of a principal spillway installation made of corrugated metal pipe, unless the chief engineer determines that testing principal spillway pipe made of other materials or testing other pipes used in the construction of dams is necessary to protect public safety, life, or property. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303b; effective Sept. 22, 2000.)

K.A.R. 5-40-15. Testing a principal spillway pipe installation in a dam; general procedures. The following general procedures shall apply to all static pressure tests required by K.A.R. 5-40-14:

(a) The applicant shall conduct the test before backfilling around and over the principal spillway pipe and after laying the pipe on the grade line and connecting the pipe according to the approved plans and the manufacturer's requirements.

(b) The applicant, the applicant's representative, or the contracting officer shall make arrangements for the chief engineer, or a person designated by the chief engineer, to be present during the test.

(c) The applicant shall place a watertight plug in the downstream end of the pipe. The plug shall be sufficient to withstand a pressure of three pounds per square inch for the duration of the test. The plug shall be equipped with an acceptable means of draining the water out of the pipe after completion of the test.

(d) The applicant shall fill the pipe with water up to an elevation of 10 feet above the flow line at the pipe outlet, or up to the principal spillway inlet elevation, whichever is less, unless a different elevation is required by the test method described in K.A.R. 5-40-16(b).

(e) The applicant shall note the exact elevation of the water surface at the time the test begins. At the end of the prescribed test duration, the applicant shall measure the water surface elevation.

(f) The applicant shall use one of the test methods described in K.A.R. 5-40-16 to determine whether the water leakage rate is acceptable.

(g) If the leakage rate determined by either of the methods described in K.A.R. 5-40-16 is not acceptable, the applicant shall determine the source of the leakage and correct the leakage. After correction, the applicant shall perform another test in accordance with K.A.R. 5-40-15 and K.A.R. 5-40-16.

(h) If the leakage rate determined by either of the methods described in K.A.R. 5-40-16 is acceptable, the applicant shall drain and backfill the pipe in the manner prescribed by the approved plans and specifications. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303b; effective Sept. 22, 2000.)

K.A.R. 5-40-16. Testing a principal spillway pipe installation in a dam; allowable leakage rate, test methods. The allowable leakage rate for a principal spillway pipe installation in a dam shall not exceed 1,000 gallons per inch diameter of pipe per mile of pipe per day. The applicant shall use one of the following test methods in determining whether the allowable leakage rate has been exceeded:

(a) The applicant shall use the following test method procedure for a drop inlet structure if the starting and ending elevation of the water is within the vertical drop structure and above the top of the barrel:

(1) Calculate the allowable leakage rate in gallons per minute for the pipe being tested based on the following formula:

The allowable leakage rate in gallons per minute = 0.000132 x d x 1 where:

d = diameter of the tested pipe in inches

1 = length of the tested pipe in feet

If the allowable leakage rate in gallons per minute is determined to be less than one, then it shall be assumed for the purposes of the test that the allowable leakage rate in gallons per minute is one.

(2) Conduct the test for 15 minutes.

(3) If the allowable leakage rate is one gallon per minute, the applicant may use the following

table to determine the allowable drop in the elevation of the water in the riser.

Nominal diameter of riser (inches)	**Allowable drop (feet)**
18	1.13
20	0.83
24	0.64
30	0.41
36	0.28

(4) If the measured drop in the riser exceeds the corresponding allowable drop in paragraph (a)(1) above, the allowable leakage rate has been exceeded, which shall not be acceptable. If the measured drop in the riser is less than or equal to the corresponding allowable drop in paragraph (a)(1) above, the allowable leakage rate has not been exceeded and shall be acceptable.

(b) The applicant shall use the following test method procedure for all other types of installations, including canopy inlets:

(1) If filling the pipe with water up to an elevation of 10 feet above the outlet puts water within the vertical riser below the top of the barrel, the elevation shall be reduced below the bottom of the vertical riser before the test begins.

(2) The allowable drop in elevation is a function of the allowable leakage rate, test duration, and the diameter and slope of the pipe. The allowable drop in the pipe in feet shall be calculated by use of the following formula:

allowable rate (gallons per minute) x test duration (minutes) x slope (%)
[diameter (inches)]2 x 4.08

(3) The minimum test duration shall be 15 minutes. If the above formula results in an allowable drop of less than 0.1 foot in 15 minutes, the test duration shall be extended so that the allowable drop is greater than 0.1 feet.

(4) The water surface elevation drop shall be measured by means of a clear plastic tube installed in the plug at the downstream end of the principal spillway pipe. Any other means of measuring the drop in elevation shall be approved by the chief engineer in advance of the test.

(5) If the measured drop is greater than the allowable drop as calculated in paragraph (b)(2), the allowable leakage rate has been exceeded, which shall not be acceptable. If the allowable drop is less than or equal to the allowable drop as calculated in paragraph (b)(2), the allowable leakage rate has not been exceeded, which shall be acceptable. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303b; effective Sept. 22, 2000.)

K.A.R. 5-40-20. Hazard classes of dams.

(a) The hazard classes of dams shall be determined from the following based on the location of the dam, the hazards found within the inundation area, and the impact of a failure of a dam:

(1) A "hazard class A dam" shall mean a dam located in an area where failure could damage only farm or other uninhabited buildings, agricultural or undeveloped land including hiking trails, or traffic on low-volume roads that meet the requirements for hazard class A dams as specified in subsections (b) and (c).

(2) A "hazard class B dam" shall mean a dam located in an area where failure could endanger a few lives, damage an isolated home, damage traffic on moderate-volume roads that meet the requirements for hazard class B dams as specified in subsections (b) and (c), damage low-volume railroad tracks, interrupt the use or service of a utility serving a small number of customers, or inundate recreation facilities, including campground areas intermittently used for sleeping and serving a relatively small number of persons.

(3) A "hazard class C dam" shall mean a dam located in an area where failure could result in any of the following:

(A) Extensive loss of life;

(B) damage to more than one home;

(C) damage to industrial or commercial facilities;

(D) interruption of a public utility serving a large number of customers;

(E) damage to traffic on high-volume roads that meet the requirements for hazard class C dams as specified in subsections (b) and (c) or a high-volume railroad line;

(F) inundation of a frequently used recreation facility serving a relatively large number of persons; or

(G) two or more individual hazards described in hazard class B.

(b) If there is a road across any part of the embankment or a spillway, including the auxiliary spillway or service spillway channel down to the receiving stream, the daily vehicular traffic shall be considered in determining the hazard classification, in addition to the criteria specified in subsection (a). The hazard classifications specified in this subsection shall be used if these classifications are more stringent than the hazard classifications required by subsection (a).

Hazard class	Vehicles per day
A	0 through 100
B	101 through 500
C	more than 500

(c) If any road in the inundation area does not meet the criteria of subsection (b), the daily vehicular traffic shall be considered in determining the hazard classification, in addition to the criteria specified in subsection (a). The hazard classifications specified in this subsection shall be used if these classifications are more stringent than the hazard classifications otherwise required by subsection (a).

Hazard class	Vehicles per day

A	0 through 500
B	501 through 1,500
C	more than 1,500

(Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-21. Class sizes of dams.

(a) Each dam that the chief engineer has authority to regulate pursuant to K.S.A. 82a-301 et seq., and amendments thereto, with an effective height of less than 25 feet and an effective storage of less than 50 acre-feet shall be considered to be a class size 1 dam. The class size of all other dams shall be determined from the following table:

Class size	Size factor
2	less than 3,000
3	3,000 through 30,000
4	more than 30,000

(b) Each existing permitted dam and each dam for which an application was submitted before the effective date of this regulation shall continue to have the effective height measured from the flow line of the stream at the centerline of the dam.
(Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-22. Design requirements for construction of a dam. Each dam constructed shall meet or exceed the design requirements specified in the table in this regulation. The minimum top of the dam elevation shall be the maximum water surface elevation determined by routing the design storm specified in the following table, using the methodology specified in K.A.R. 5-40-30 through K.A.R. 5-40-33, through the reservoir and the dam's spillways, plus the minimum freeboard shown in the following table. The minimum floor width of the open-channel spillway shall be the minimum floor width shown in the following table:

Dam size class	Hazard class	Precipitation for design storm	Minimum freeboard in feet	Minimum floor width of open-channel spillway in feet
1	A	2% chance	1	20
	B	0.25 PMP	2	
	C	0.40 PMP	3	
2	A	1% chance	2	30
	B	0.25 PMP	2	
	C	0.40 PMP	3	
	A	1% chance	3	40

3	B	0.30 PMP	3	
	C	0.40 PMP	3	
4	A	0.25 PMP	3	40
	B	0.30 PMP	3	
	C	0.40 PMP	3	

(Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-23. Detention storage.

(a) To determine the minimum required detention storage, the applicant shall show that the computed runoff from the detention storm can be stored in the reservoir and discharged through the primary spillway without any flow being discharged through the auxiliary spillway. The elevation of the auxiliary spillway control section shall be set so that the computed runoff from the detention storm specified in the following table and determined from the procedures in K.A.R. 5-40-30 through K.A.R. 5-40-33 does not result in discharge through the auxiliary spillway.

Hazard class	Size	Purpose	Minimum detention storm
A	1, 2	Flood control	4% chance
A	3	Flood control	4% chance
A	4	Flood control	2% chance
B	All	Flood control	2% chance
C	All	Flood control	2% chance
A	1, 2	All uses other than flood control	50% chance
A	3	All uses other than flood control	50% chance
A	4	All uses other than flood control	20% chance
B	All	All uses other than flood control	20% chance
C	All	All uses other than flood control	20% chance

Each dam that has flood control as a purpose shall meet the detention storm requirements for a flood control structure. A dam that is not constructed for flood control purposes and whose auxiliary spillway meets the requirements for a service spillway in K.A.R. 5-40-57 shall not be required to meet any minimum detention storm requirement in the table in this subsection.

(b) Each dam shall have a primary spillway and an auxiliary spillway, unless a service spillway meeting the requirements of K.A.R. 5-40-57 is provided. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-24. Dam breach analysis. A dam breach analysis shall be conducted on each proposed dam as specified in this regulation. If a dam breach analysis is required for

an existing dam, the analysis shall be conducted in the same manner as that specified in this regulation for a proposed dam.

(a) To determine the appropriate water surface elevation in the reservoir when the breach begins, the breach analysis shall route the appropriate design duration one percent-chance storm determined by K.A.R. 5-40-31 through the reservoir. The routing shall begin by assuming that the water surface elevation is at the elevation of the lowest uncontrolled spillway inlet, not including any low-flow augmentation works. The antecedent moisture condition (AMC) used to determine the runoff shall be determined according to K.A.R. 5-40-32. The minimum water surface elevation used to begin the breach analysis shall be the greater of the following:

(1) The water surface elevation determined by routing the required design duration one percent-chance storm through the reservoir; or

(2) the elevation of the crest of the auxiliary spillway.

Routing the storm through the reservoir may account for the discharge of the primary spillway and any open-channel spillways. If the dam does not have an open-channel spillway, the water surface elevation used shall be the elevation of the top of the dam or the elevation resulting from using PMP as the runoff event, whichever is lower.

(b) The breach discharge shall be determined by using the peak breach discharge criteria section on pages 1-1 through 1-2 in "earth dams and reservoirs," TR-60, dated July 2005, published by the conservation engineering division of the natural resources conservation service, and hereby adopted by reference, unless the applicant receives written approval of the chief engineer to use a model that is more appropriate for a particular dam. The breach discharge hydrograph shall be determined by methods in NRCS TR-66, third edition, "simplified dam-breach routing procedure," dated September 1985, which is hereby adopted by reference, including the appendices. If another model is used, the following breach modeling assumptions shall be used, unless the applicant demonstrates to the chief engineer that more appropriate assumptions should be used:

(1) The parameters shall support the assumption of a rapidly developing breach that is either an overtopping failure or a spillway failure caused by intense, localized erosion beginning at the downstream end of the auxiliary spillway or service spillway and working its way upstream.

(2) If the breach model has breach width as a variable, the minimum bottom width of the breach shall be twice the height of the dam. If there is a well-defined physical floodplain, the height of the dam may be measured from the top of the low bank of the stream to the top of the dam for the purpose of determining the minimum breach width.

(3) If the side slopes of the breach are a parameter of the model, vertical side slopes shall be used.

(4) If the breach model has breach time as a variable, the maximum breach time shall be one minute per foot of height of the dam.

(c) The breach discharge shall be routed downstream using a hydraulic flow model in accordance with sound engineering principles and commonly accepted engineering practices. An unsteady state hydraulic flow model shall be used if it is

necessary to model existing hydraulic structures in the inundation area. In all other instances, a steady state hydraulic flow model may be used.

(d) The inundation area analyzed shall meet both of the following requirements:

(1) Be from the downstream toe of the dam and the control section of any open-channel section of any open-channel spillway, downstream to the point where the crest of the breach wave intersects the flood level of the peak discharge of the one percent-chance storm, assuming that the dam was not in place; and

(2) be analyzed to the point at which there are no more hazards downstream.

The peak discharge of the one percent-chance storm may be determined by any of the methods provided in K.A.R. 5-42-5 or the appropriate published flood insurance study for the stream receiving the discharge from the breach of the dam.

(e) If there is more than one dam on a stream, it shall be assumed that the most upstream dam is breached first and that the peak flow of that breach arrives at the next downstream dam at the same time the peak water surface elevation from the inflow of the one percent-chance storm from the uncontrolled portion of the lower dam's drainage area occurs. An appropriate model may be used to demonstrate when the peaks will occur for an entire system of dams, in which case the water surface elevation modeled shall be used.

(f) If there are dams on separate tributaries above the dam being analyzed, the modeling assumption specified in subsection (e) shall be applied only to the tributary that has the upstream dam whose breach results in the greatest computed breach discharge at the dam being analyzed.

(g) If digital elevation data is used in the analysis of the breach, the data used shall have a root mean square error of 2.5 meters or less.

(h) Cross sections for modeling purposes shall be taken at appropriate locations, but in no case shall the intervals be less than 2,640 feet measured along the floodplain of the watercourse. Cross sections shall be generally perpendicular to the direction of flow and the contour lines that the cross sections intersect. Cross sections may be broken into several connected segments as needed to meet the requirements of this subsection.

(i) Each bridge and any other hydraulic structure that has a significant hydraulic effect shall be included in the analysis.

(j)(1) The applicant shall submit a contour map of the valley with contour intervals of 10 feet or less and a scale of not less than 1:24,000, which shall show the following:

(A) The inundation area determined from the breach;

(B) the location of each existing hazard; and

(C) each cross section entered in the hydraulic flow model with a label identifying the cross section.

(2) The following items shall be shown on the contour map or on separate documentation:

(A) The elevation of each existing hazard;

(B) the water surface elevation at each existing hazard;

(C) the elevation of the streambed at the point nearest each existing hazard; and

(D) a tabular report including the following information for each cross section:

(i) The label identifying each cross section shown on the map;

(ii) the elevation of the maximum water surface attained during the breach;

(iii) the peak discharge; and

(iv) the computed width of the water surface.

(3) If there are more than 10 hazards in any 2,640-foot reach in the flood inundation area, the information required in paragraph (j)(2) may be noted only for the hazard in that reach that is closest to the maximum water surface elevation measured vertically and the hazard in that reach that is farthest from the maximum water surface elevation measured vertically.

(k) The applicant shall submit one copy of each data file used to perform each analysis in electronic form along with identification of the computer programs used to perform the analysis and any model documentation needed for the chief engineer to review the analysis. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-26. Request to issue or reconsider hazard class determination.

(a)(1) If an owner or applicant does not agree with the hazard classification determined for a dam, the owner or applicant may file a request for reconsideration of the hazard class determination.

(2) Each request for reconsideration shall be submitted in writing and shall indicate the following:

(A) The owner's or applicant's proposed hazard classification;

(B) the basis of that proposal; and

(C) an explanation of why the owner or applicant believes that the determination of the hazard classification by the chief engineer is incorrect. The request shall also contain documentation and analysis that support the request.

(3) Each request for reconsideration shall be filed with the chief engineer within 15 days after the owner or applicant is served with written notice of the hazard classification by the office of the chief engineer or within any extension of time authorized by the chief engineer in writing.

(b) Each request for reconsideration shall be reviewed by the chief engineer, and a final written determination of the hazard classification shall be made by the chief engineer.

(c) If the chief engineer has not issued a written notice of the hazard classification, the owner or applicant may request a written notice after the owner or applicant has been informed verbally of the proposed hazard classification by the chief

engineer. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-30. Time of concentration.

(a) Except as specified in subsections (b) and (c), the time of concentration (T_c) shall be determined by using one of the methods specified in chapter 15, "travel time, time of concentration and lag," in the natural resources conservation service (NRCS) national engineering handbook, part 630, dated August 1972, which is hereby adopted by reference.

(b) For drainage areas of not more than three square miles, the time of concentration (T_c) may be determined by use of the Kirpich formula, which is as follows:

$$T_c = \left(\frac{11.9L^3}{H} \right)^{0.385}$$

Where
T_c = the time of concentration, in hours
L = the longest distance that water has to travel in the drainage basin, in miles
H = the maximum elevation difference in the drainage basin, in feet.

(c) In addition to the methods specified in subsections (a) and (b), the applicant may determine T_c based on sound engineering principles and commonly accepted engineering practices if the applicant obtains the prior written consent of the chief engineer. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-31. Design duration rainfall depth.

(a) If the time of concentration is six hours or less, a duration of six hours shall be used for all design storms. The appropriate six-hour storm depth, in inches, shall be selected from the following table.

County	Probability of occurrence in any year					
	50%	20%	4%	2%	1%	PMP
Allen	2.7	3.5	4.8	5.4	6.1	28.0
Anderson	2.7	3.5	4.8	5.3	6.0	27.8
Atchison	2.6	3.4	4.5	5.1	5.7	27.2
Barber	2.4	3.2	4.4	5.0	5.7	27.3
Barton	2.3	3.0	4.1	4.8	5.3	26.6
Bourbon	2.7	3.5	4.8	5.4	6.0	28.1
Brown	2.5	3.2	4.4	5.0	5.6	27.0
Butler	2.6	3.4	4.7	5.3	6.0	27.7
Chase	2.6	3.4	4.6	5.2	5.9	27.5
Chautauqua	2.7	3.5	4.9	5.5	6.2	28.3
Cherokee	2.8	3.6	5.0	5.5	6.2	28.5
Cheyenne	1.8	2.4	3.4	3.8	4.3	24.7

County	Probability of occurrence in any year					
	50%	20%	4%	2%	1%	PMP
Clark	2.2	3.0	4.1	4.7	5.3	26.7
Clay	2.5	3.2	4.3	5.0	5.5	26.8
Cloud	2.4	3.1	4.2	4.8	5.4	26.6
Coffey	2.7	3.5	4.7	5.3	6.0	27.8
Comanche	2.3	3.1	4.2	4.9	5.5	27.0
Cowley	2.6	3.4	4.8	5.4	6.1	28.0
Crawford	2.8	3.6	4.9	5.4	6.1	28.3
Decatur	1.9	2.6	3.6	4.2	4.6	25.3
Dickinson	2.5	3.2	4.4	5.1	5.6	27.1
Doniphan	2.5	3.2	4.5	5.0	5.6	27.0
Douglas	2.6	3.4	4.6	5.2	5.8	27.5
Edwards	2.2	2.9	4.1	4.7	5.3	26.7
Elk	2.7	3.5	4.8	5.4	6.1	28.1
Ellis	2.1	2.9	3.9	4.6	5.0	26.2
Ellsworth	2.3	3.1	4.2	4.9	5.4	26.7
Finney	2.0	2.6	3.8	4.3	4.8	26.8
Ford	2.1	2.8	4.0	4.6	5.1	26.4
Franklin	2.7	3.5	4.7	5.2	5.9	25.8
Geary	2.5	3.2	4.4	5.1	5.7	27.1
Gove	2.0	2.6	3.7	4.3	4.7	25.7
Graham	2.0	2.7	3.8	4.4	4.8	25.8
Grant	1.9	2.6	3.7	4.2	4.7	25.6
Gray	2.0	2.7	3.9	4.4	4.9	26.1
Greeley	1.8	2.5	3.4	3.9	4.4	25.0
Greenwood	2.7	3.5	4.8	5.3	6.1	27.8
Hamilton	1.8	2.5	3.5	4.0	4.5	25.2
Harper	2.5	3.3	4.5	5.2	5.9	27.5
Harvey	2.5	3.3	4.5	5.1	5.8	27.4
Haskell	2.0	2.7	3.8	4.3	4.8	25.9
Hodgeman	2.1	2.8	3.9	4.5	5.0	26.3
Jackson	2.6	3.4	4.5	5.1	5.7	27.2
Jefferson	2.6	3.4	4.6	5.1	5.8	27.3
Jewell	2.3	2.9	4.0	4.7	5.1	26.3
Johnson	2.6	3.4	4.6	5.2	5.8	27.5
Kearny	1.9	2.6	3.6	4.1	4.6	25.5
Kingman	2.4	3.2	4.4	5.1	5.7	27.3
Kiowa	2.2	2.9	4.2	4.8	5.4	26.7
Labette	2.8	3.6	5.0	5.5	6.2	28.4
Lane	2.0	2.7	3.7	4.3	4.8	25.8
Leavenworth	2.6	3.4	4.6	5.1	5.8	27.4
Lincoln	2.3	3.0	4.2	4.8	5.3	26.6
Linn	2.7	3.5	4.8	5.3	6.0	27.9
Logan	1.9	2.5	3.6	4.1	4.6	25.3
Lyon	2.6	3.4	4.6	5.2	6.0	27.5

County	Probability of occurrence in any year					
	50%	20%	4%	2%	1%	PMP
Marion	2.5	3.3	4.5	5.2	5.8	27.3
Marshall	2.5	3.2	4.3	4.9	5.5	26.8
McPherson	2.5	3.2	4.4	5.1	5.7	27.1
Meade	2.1	2.8	4.0	4.6	5.1	26.3
Miami	2.7	3.5	4.7	5.2	5.9	27.7
Mitchell	2.3	3.0	4.1	4.7	5.2	26.4
Montgomery	2.8	3.5	5.0	5.5	6.2	28.3
Morris	2.6	3.4	4.5	5.1	5.8	27.3
Morton	1.9	2.5	3.6	4.1	4.6	25.4
Nemaha	2.5	3.2	4.4	5.0	5.6	26.9
Neosho	2.7	3.5	4.9	5.5	6.1	28.2
Ness	2.1	2.8	3.9	4.5	4.9	26.1
Norton	2.0	2.6	3.7	4.3	4.7	25.6
Osage	2.6	3.4	4.6	5.2	5.9	27.5
Osborne	2.2	2.9	4.0	4.6	5.1	26.2
Ottawa	2.4	3.1	4.3	4.9	5.4	26.8
Pawnee	2.2	2.9	4.1	4.7	5.2	26.6
Phillips	2.1	2.8	3.8	4.4	4.9	25.8
Pottawatomie	2.5	3.2	4.4	5.0	5.6	27.0
Pratt	2.3	3.1	4.3	4.9	5.5	27.0
Rawlins	1.9	2.5	3.5	4.0	4.5	25.0
Reno	2.4	3.2	4.4	5.0	5.7	27.2
Republic	2.3	3.0	4.1	4.8	5.3	26.4
Rice	2.4	3.1	4.3	4.9	5.5	26.9
Riley	2.5	3.2	4.4	5.0	5.6	27.0
Rooks	2.1	2.8	3.9	4.5	4.9	26.0
Rush	2.2	2.9	4.0	4.6	5.1	26.4
Russell	2.2	2.9	4.1	4.7	5.2	26.5
Saline	2.4	3.1	4.3	5.0	5.5	26.9
Scott	1.9	2.6	3.6	4.2	4.7	25.5
Sedgwick	2.5	3.3	4.6	5.2	5.9	27.5
Seward	2.0	2.7	3.8	4.4	4.9	26.0
Shawnee	2.6	3.4	4.6	5.1	5.8	27.4
Sheridan	2.0	2.6	3.7	4.2	4.7	25.5
Sherman	1.8	2.4	3.4	3.9	4.4	24.8
Smith	2.2	2.9	3.9	4.6	5.0	26.1
Stafford	2.3	3.0	4.2	4.9	5.4	26.9
Stanton	1.9	2.5	3.6	4.1	4.5	25.3
Stevens	1.9	2.6	3.7	4.3	4.7	25.8
Sumner	2.6	3.4	4.7	5.3	6.0	27.8
Thomas	1.9	2.5	3.5	4.1	4.5	25.2
Trego	2.0	2.7	3.8	4.4	4.9	25.9
Wabaunsee	2.6	3.4	4.5	5.1	5.8	27.3
Wallace	1.8	2.4	3.4	3.9	4.4	24.9

County	Probability of occurrence in any year					
	50%	20%	4%	2%	1%	PMP
Washington	2.4	3.1	4.2	4.9	5.4	26.6
Wichita	1.9	2.5	3.5	4.1	4.5	25.3
Wilson	2.7	3.5	4.9	5.4	6.1	28.1
Woodson	2.7	3.5	4.8	5.4	6.1	28.0
Wyandotte	2.6	3.4	4.6	5.1	5.8	27.4

(b) If the time of concentration of the watershed, or any subwatershed being used to develop the inflow hydrograph, is more than six hours, the ratio for the time equal to or greater than the computed time of concentration shall be selected from the following table. Linear interpolation shall be acceptable. That ratio shall be multiplied by the depth of the six-hour rainfall in the table in subsection (a). The resulting depth is the design duration rainfall depth.

Relative increase in rainfall amount for storm durations over six hours

Time (hours)	100-year ratio	PMP ratio
6	1.000	1.000
6.5	1.019	1.013
7	1.035	1.025
7.5	1.051	1.037
8	1.066	1.048
8.5	1.081	1.058
9	1.094	1.068
9.5	1.108	1.078
10	1.120	1.087
10.5	1.132	1.096
11	1.144	1.104
11.5	1.155	1.112
12	1.166	1.120
13	1.187	1.134
14	1.207	1.148
15	1.225	1.161
16	1.243	1.173
17	1.259	1.185
18	1.275	1.196
20	1.305	1.217
22	1.333	1.236
24	1.359	1.254

(c) If the drainage area exceeds 10 square miles, the rainfall depth obtained from the table in subsection (a) may be reduced by the ratio shown in the table in this subsection. The ratio for the zone in which the dam is located and a drainage area less than or equal to the actual drainage area above the dam shall be selected. The use of linear interpolation shall be acceptable. That ratio shall be multiplied by the depth of rainfall from the table in subsection (a). The result is the design duration rainfall depth. The ratios in subsection (b) and this subsection may be used together, if subsections (b) and (c) both apply.

Drainage area (sq. mi.)	Reduction ratio		
	Zone 1	Zone 2	Zone 3
10	1.00	1.00	1.00
12	0.99	0.99	0.98
15	0.97	0.95	0.93
17	0.96	0.94	0.91
20	0.94	0.91	0.88
22	0.93	0.90	0.86
25	0.92	0.88	0.83
27	0.92	0.87	0.82
30	0.91	0.86	0.80
35	0.90	0.84	0.77
40	0.88	0.82	0.75
45	0.87	0.80	0.72
50	0.86	0.78	0.70
60	0.84	0.75	0.65
70	0.82	0.72	0.62
80	0.80	0.70	0.59
90	0.79	0.68	0.57
100	0.78	0.67	0.55

Zone 1, zone 2, and zone 3 shall have the meanings specified in K.A.R. 5-40-1 under the definition of a “stream.” (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-32. Determination of rainfall excess.

(a) Rainfall excess shall be determined by using the natural resource conservation service (NRCS) runoff curve number method.

(b) The antecedent moisture condition (AMC) to be used when determining the curve number for the design storm shall be one of the following:

(1) For zone one, the curve number determined using AMC III;

(2) for zone two, the curve number determined by averaging the AMC II and AMC III curve numbers; or

(3) for zone three, the curve number determined using AMC II.

Zone one, zone two, and zone three shall have the meanings specified in K.A.R. 5-40-1 under the definition of a "stream."

(c) If the drainage basin is in two zones, the curve number may be weighted based on the drainage area within each zone.

(d) AMC II shall be used in determining the rainfall-runoff relationship used to compute the required detention storage. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-33. Hydrographs. The rainfall excess determined in K.A.R. 5-40-32 shall be used to determine the time-discharge relationship of inflow to the reservoir for the detention storm and design storm using the techniques described in chapter 16, "hydrographs," in the natural resource conservation service (NRCS) national engineering handbook, part 630, dated March 2007, which is hereby adopted by reference. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-40. Geotechnical investigation of all dams.

(a) Each applicant shall ensure that a sufficient geotechnical investigation is performed on the proposed site for each dam to design the dam in accordance with the regulations of the chief engineer and with sound engineering principles and commonly accepted engineering practices. The materials under the proposed dam, open-channel spillway, and borrow area shall be investigated before design and submission of the application for a permit to construct a dam. If unusual or unexpected foundation conditions are encountered in the investigations required in this regulation, additional geotechnical investigation and soil mechanics testing shall be performed as necessary to design and construct the dam in accordance with the regulations of the chief engineer and with sound engineering principles and commonly accepted engineering practices.

(b) The geotechnical investigation specified in these regulations shall be designed by a licensed professional competent in geotechnical investigation and analysis for dams.

(c) The geotechnical information specified in these regulations shall be included in the engineering design report and submitted with the proposed construction plans. The report shall contain a general description of the geotechnical investigation, including the method used for sampling.

(d) The soils sampled in all of the geotechnical investigations shall be classified by using field classification methods and the uniform soil classification system.

(e) The dam design shall make appropriate accommodations for the geology discovered in the investigation.

(f)(1) The foundation of the dam shall be investigated to a depth of not less than one-half the height of the dam at the location of the test hole plus five feet.

(2) If unweathered bedrock is encountered before reaching the sampling depth required in paragraph (f)(1), the sampling shall be done to the unweathered bedrock.

(g) The static water level in each test hole shall be recorded.

(h) A sufficient number of test holes shall be made in each open-channel spillway to determine the stability of the spillway crest and the outlet channel down to the streambed elevation.

(i) A sufficient number of test holes in the borrow area shall be made to determine the amount of suitable material available and to classify the soil to be used in the embankment. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-41. Geotechnical investigation of a low-impact dam.

(a) In addition to meeting the requirements of K.A.R. 5-40-40, each low-impact dam shall have a sufficient number of properly placed test holes to be representative of the geology under the proposed dam embankment, with an average of at least one test hole each 200 feet along the centerline of the dam and at least three test holes.

(b) Except as specified in subsection (d) and K.A.R. 5-40-74, each existing unpermitted, illegal dam shall have the same level of geotechnical investigation as that required for a proposed new dam, except that testing the borrow area shall not be required, before a permit will be issued. In addition, the condition of the following shall be determined:

(1) All conduits passing through the embankment;

(2) the embankment in the vicinity of the conduits; and

(3) the rest of the embankment, including any slides, seeps, saturated areas, sloughs, and other visible anomalies in the embankment.

(c) If there are any signs of instability in the embankment, the stability of the slope of the existing embankment shall be analyzed according to the requirements of K.A.R. 5-40-46(c).

(d) An existing unpermitted, illegal low-hazard dam that is class size 1, 2, or 3, for which a qualified professional has conducted an inspection and submitted to the chief engineer a report of that investigation demonstrating that a geotechnical investigation is not necessary to protect the public safety and property, shall not be required to have the geotechnical investigation required by subsection (b). (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-42. Geotechnical investigation of a high-impact dam.

(a) In addition to meeting the requirements of K.A.R. 5-40-40, each proposed high-impact dam shall have at least the following number of geotechnical test holes:

(1) A sufficient number of properly placed test holes to be representative of the geology under the proposed dam embankment, with an average of at least one test hole every 100 feet along and as close to the centerline of the dam as practical and a minimum of three test holes; and

(2) a test hole as close as practical to the anticipated location of the following:

(A) The base of the drop inlet; and

(B) the support of the outlet pipe.

(b) At least one representative sample of undisturbed soil shall be tested to determine shear strength parameters, permeability, and compressability.

(c) The geotechnical investigation shall determine the following for at least one representative sample:

(1) Atterberg limits;

(2) the settlement characteristics of the proposed embankment materials and the foundation of the dam;

(3) the Proctor compaction curves of soils;

(4) gradation tests of foundation materials, especially where drain systems could be located; and

(5) any other properties necessary to design a dam to meet the requirements of the regulations of the chief engineer, sound engineering principles, and commonly accepted engineering practices.

(d) Each existing unpermitted, illegal dam shall have the same level of geotechnical investigation as that required for a proposed dam, except that testing the borrow area shall not be required, before a permit may be issued. In addition, the following properties shall be determined:

(1) The condition of all conduits passing through the embankment and the condition of the embankment in the vicinity of the conduits;

(2) the in situ density of the existing embankment and its foundation;

(3) the condition of the embankment, including any slides, seeps, saturated areas, sloughs, and other visible anomalies in the embankment; and

(4) a slope stability analysis of the existing embankment, which shall be performed according to the requirements of K.A.R. 5-40-46. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-43. Cutoff trench.

(a) Each dam shall have a cutoff trench. The cutoff trench shall meet all of the following requirements:

(1) Have side slopes no steeper than one horizontal unit to one vertical unit;

(2) have a bottom width of 10 or more feet as necessary to meet the compaction requirements of K.A.R. 5-40-44;

(3) be constructed to the depth justified in the design report based on the findings in the geotechnical report, unless observations by the inspecting engineer during construction justify a different depth;

(4) be backfilled with the most impervious material available at the site. If no impervious material is available at the site, then this material shall be procured off-site;

(5) be backfilled with material that is contiguous to and homogeneous with the most impervious zone within the dam, if the dam is designed as a zoned fill;

(6) be constructed in lifts that shall not exceed nine inches for each lift; and

(7) be constructed of a material that has been brought to acceptable moisture content.

(b) The material placed in the cutoff trench shall be placed according to the same specifications as those required for the embankment in K.A.R. 5-40-44. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-44. Embankment.

(a) The minimum top width of an embankment shall be determined from the following table:

Height of dam (in feet)	Minimum top width (in feet)
less than 20	10
20 through 24.9	12
25 through 39.9	14
40 or greater	15

(b) The top of the dam shall be sloped toward the reservoir, unless special measures are taken to adequately control erosion on the downstream side of the dam.

(c) The height of each lift in the embankment and cutoff trench shall be no more than nine inches, unless the dam is designed as a zoned fill. If the dam is designed as a zoned fill, the lifts outside the cutoff trench and most impermeable zone may be larger if geotechnical data is provided that shows that adequate compaction can be achieved using lifts in excess of nine inches.

(d) The material in each low-impact embankment and cutoff trench shall be brought to a moisture content that can be compacted in accordance with this subsection. Each application for a low-impact dam shall contain specifications requiring adequate compaction. The minimum compaction required shall be achieved by one of the following:

(1) Using a sheepsfoot roller until the feet cease to push into the fill material and start to walk across the compacted surface;

(2) using the controlled movement of rubber-tired earth-moving equipment so that every point on the surface of each lift is traversed by not less than one tread track of the equipment; or

(3) using another method that achieves the compaction required by this subsection.

(e) Each high-impact dam shall include the following in its specifications for earth placement in the embankment and cutoff trench:

(1) The minimum and maximum allowable levels of soil moisture;

(2) the compaction standards;

(3) a provision for testing the soils placed during construction; and

(4) a means to ensure that the compaction standards approved by the chief engineer are met during construction.

(f) In addition to the requirements of subsections (d) and (e), the specifications for hand-compacted fill around each conduit in the embankment shall meet the following requirements:

(1) Set a maximum lift of one-third the diameter of the outside of the conduit. However, no lift shall exceed four inches; and

(2) specify a minimum distance around the conduit for hand compaction. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-45. Allowance for settlement of an earthen dam.

(a) A detailed soil mechanics investigation report shall be submitted as part of the design report for each high-impact dam. An appropriate allowance for settlement shall be made based on the results in the soil mechanics report.

(b) If a detailed soil mechanics investigation report is not submitted for a low-impact dam, at least five percent of the height of the dam shall be allowed for settlement of the embankment.

(c) An allowance for settlement on each dam may be made by steepening the side slopes during construction and adding to the height of the embankment as needed to increase the height of the dam. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-46. Side slopes of an earthen dam.

(a) The side slopes of each earthen dam shall be designed and constructed to be stable and easily maintained.

(b) A slope stability analysis shall be required on each high-impact dam.

(c) If a slope stability analysis is required, the minimum factor of safety shall be based on the steady-state seepage load condition with the water level at the elevation of the lowest open-channel spillway or other uncontrolled spillway with a trash rack that meets the requirements of K.A.R. 5-40-51, as shown in the following table:

Class size	Hazard class	Factor of safety

4	A	1.4
3, 4	B	1.5
1, 2, 3, 4	C	1.5

(d) Each dam whose face is subject to prevailing winds shall be given additional protection from erosion caused by wave action, which may include a flatter side slope, the use of riprap, or the use of grass or vegetation adapted to fluctuating water levels. The design of any slope protection for the embankment and the auxiliary spillway or service spillway shall be shown on the plans. If no slope protection is provided, regardless of the orientation of the dam, the design report shall provide justification for not having slope protection.

(e) The steepest allowable design side slope shall be three horizontal units to one vertical unit on the upstream side of the dam, and two and one-half horizontal units to one vertical unit on the downstream slope of the dam. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R 5-40-50. Pipes.

(a) Each pipe under or through an embankment shall meet the following requirements:

(1) Be capable of withstanding the external load without buckling, cracking, being damaged, or being deformed. The minimum internal diameter of the pipe shall not be reduced by more than the pipe manufacturer's stated allowable, long-term pipe deflection limit and in no case by more than five percent;

(2) be designed to adequately resist flotation;

(3) be impervious to water, with watertight joints and seams;

(4) except for drawdown pipes, be installed with sufficient slope to provide adequate drainage, with a minimum average slope of one percent after settlement. No pipe shall have an adverse grade through any section of pipe;

(5) if the pipe is installed in conjunction with a riser on a high-impact dam, be placed to insure that the requirements of paragraph (a)(4) are met and that all pipe sections are properly aligned after settlement of the foundation and consolidation of the embankment;

(6) have the discharge end extended a sufficient distance beyond the downstream toe of the dam to avoid erosion to the dam;

(7) be adequately supported at the discharge end to prevent deflection when the pipe is flowing full; and

(8) if the pipe is a primary spillway, be sized to evacuate 95 percent of the detention storage in 14 or fewer days.

(b) Steel cylinder-reinforced concrete pipe shall be acceptable for use in any dam if the design computations, plans, and specifications related to the placement of the pipe meet the minimum requirements of the manufacturer.

(c) In applying the provisions of subsections (c), (e), and (f), the depth of fill over the top of each pipe shall be measured from the top of the embankment after settlement has occurred. Reinforced concrete pipe shall be acceptable for use in a low-impact dam if less than 30 feet of fill will be placed over the pipe and if the design computations, plans, and specifications related to the placement of the pipe meet the minimum requirements of the manufacturer.

(d) Each metal pipe shall be coated with a protective coating adequate to prevent corrosion for the planned life of the dam, or the design report shall include an estimate of the expected life of the pipe, the expected life of the dam, and a plan for replacement of the pipe when it no longer functions as designed.

(e) Corrugated metal pipe shall be acceptable for use in any hazard class A or B dam if no more than 25 feet of fill is placed over the pipe.

(f)(1) Polyvinyl chloride pipe shall be acceptable for use in any dam if the maximum fill over the pipe does not exceed the depth specified in the following table:

Standard dimension ratio (SDR)	Maximum fill over top of pipe (feet)
SDR 17 and thicker	35
SDR 18	31
SDR 21	23
SDR 25	18
SDR 26	16
SDR 28	14

A pipe with walls thinner than SDR 28 shall not be used.

(2) Polyvinyl chloride pipe shall not be placed in high-plasticity soils.

(3) Each portion of polyvinyl chloride pipe that will be exposed to sunlight shall be protected as recommended by the manufacturer of the pipe or shall be encased in a protective material.

(g) Pipe materials other than those described in subsections (b) through (f) may be used if the applicant demonstrates that all of the following criteria are met:

(1) The pipe material, accounting for any protective measures that will be taken, has a minimum expected life of 25 years if exposed to sunlight or buried in soil with the same characteristics of the soil to be used to construct the dam.

(2) All of the pipe manufacturer's design recommendations are met by the plans and specifications for the dam and are documented in the design report.

(3) All of the pipe manufacturer's recommendations for bedding, supporting, and installing the pipe are included in the specifications for construction of the dam, except those specifications that are demonstrated in the design report to be inapplicable in the construction of the proposed dam.

(4) The design report includes an estimate of the life of the pipe, the life of the dam, and a plan to replace the pipe when it no longer functions as designed if the design life of the pipe is less than that of the dam.

(5) The design report demonstrates that the proposed placement and use of the pipe will meet the requirements of sound engineering principles and commonly accepted engineering practices.

(h) If the estimated life of a pipe is less than the estimated life of the dam, the permit shall contain the condition that the pipe shall be replaced when the pipe no longer functions properly. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-51. Acceptable trash racks for primary spillways.

(a) Except as specified in subsection (c), each new or modified primary spillway permitted on or after the effective date of this regulation shall be equipped with an acceptable trash rack, as specified in subsection (b).

(b) "Acceptable trash rack" shall mean a trash rack designed and constructed to prevent debris from clogging the inlet of the primary spillway or the primary spillway conduit. Each acceptable trash rack shall be constructed of material of sufficient strength to withstand the impact of the material that could strike the inlet.

(c)(1) Each primary spillway in a dam permitted before the effective date of this regulation shall be equipped with the acceptable trash rack required by the permit and approval of design. If no trash rack was required by the permit and approval of design, no trash rack shall be required unless the primary spillway fails to function properly.

(2) If the applicant demonstrates that there is not sufficient woody vegetation or other debris in the drainage area to justify the installation of an acceptable trash rack, the requirement to have an acceptable trash rack may be waived.

(d) If a fish screen is installed, the screen shall not impair the functioning of the primary spillway. If a fish screen is proposed, the design report shall demonstrate that the screen is designed in accordance with the standards of subsection (b) and will not impair the functioning of the primary spillway. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-52. Stilling basins.

(a) For each new dam, for each primary spillway conduit replacement, and for each existing dam for which the chief engineer determines that it is necessary to protect the integrity of the embankment, each primary spillway conduit with a cross-sectional area in excess of 1.75 square feet shall discharge into one of the following:

(1) A constructed stilling basin below the downstream toe of the dam; or

(2) any other constructed works designed to dissipate energy and prevent erosion.

(b) If a stilling basin is required or constructed, the stilling basin shall be designed to dissipate the energy of the water exiting the conduit so that the stilling basin

discharges water to the receiving channel without causing excessive erosion and the stilling basin itself is not damaged by full conduit flow.

(c) The invert of the outlet conduit that discharges into a stilling basin shall be located at least one foot above the tailwater elevation in the stilling basin when water is flowing through the primary spillway at the maximum rate of discharge during the design storm. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-53. Drawdown pipes.

(a) Except as specified in subsection (b), each dam shall be equipped with a drawdown pipe that meets the requirements for a pipe as specified in K.A.R. 5-40-50. A valve or gate shall be installed in the pipe so that the controls are accessible and damage from freezing is prevented. Drawdown pipes may be incorporated into the primary spillway.

(b) The installation of a drawdown pipe shall not be required for a low-impact dam if the chief engineer determines that both of the following criteria are met:

(1) The failure to install a drawdown pipe will not prejudicially and unreasonably affect the public interest and the public safety.

(2) The drawdown pipe is not necessary to administer water rights.

(c) Each drawdown pipe shall have the capacity to evacuate 90 percent of the volume of the permanent pool in 14 or fewer days assuming no inflow into the reservoir, but in no case shall the drawdown pipe have an internal diameter of less than four inches. The inlet of the drawdown pipe shall be constructed to reduce the likelihood of plugging. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-54. Control of seepage along a conduit.

(a) Each conduit through any portion of a dam below the elevation of the permanent pool shall be constructed to protect the dam from seepage along the conduit by means of cutoff collars or a drainage diaphragm. Cutoff collars may be used only on hazard class A dams that are class sizes one and two.

(b) Each drainage diaphragm shall meet all of the following design criteria:

(1) Be installed so that the largest face is perpendicular to the conduit;

(2) be sized as follows:

(A) If the conduit is circular, the diaphragm shall extend a minimum of two feet or three times the outside diameter of the conduit, whichever is greater, from the outside surface of the conduit horizontally and vertically upward. The diaphragm shall extend vertically downward a minimum of two feet from the outside surface of the conduit;

(B) if the conduit is rectangular, the diaphragm shall extend minimum of two feet or three times the vertical dimension of the conduit, whichever is greater, from the outside surface of the conduit horizontally and vertically upward. The diaphragm shall

extend vertically downward a minimum of two feet from the outside surface of the conduit;

(C) a drainage diaphragm shall not be required to penetrate unweathered bedrock; and

(D) the diaphragm shall not be required to extend vertically upward to an elevation higher than the crest of the auxiliary spillway;

(3) have a dimension parallel to the conduit that is at least three feet thick;

(4) except as specified in subsection (d), be located downstream of the centerline of the dam, downstream of the cutoff trench, and far enough upstream of the toe so that there is a minimum of two feet of fill, measured perpendicular to the surface of the embankment, over the top of the diaphragm after settlement of the embankment; and

(5) have an outlet that provides positive drainage of the diaphragm to the stilling basin

or other point below the downstream toe of the dam. The flow line of the outlet shall be no lower than one-half foot above the elevation of the outlet of the stilling basin.

(c) Except as specified in subsection (d), each cutoff collar shall meet all of the following design criteria:

(1) Be constructed of the same or similar material as that of the conduit;

(2) be attached to the conduit with a watertight seal;

(3) be of sufficient size and number to increase the length of the seepage path by at least 15 percent;

(4) be spaced at intervals of at least twice the vertical dimension of the largest collar being used;

(5) be located along the conduit in that portion of the dam that will be saturated;

(6) project a minimum of two feet beyond the outside wall of the conduit; and

(7) be located no closer than two feet from any conduit joint.

(d) If cutoff collars or a drainage diaphragm is located in a zoned fill, the location shall be justified in the design report and established in accordance with sound engineering principles and commonly accepted engineering practices.

(e) If another drain included in the design meets the requirements for a diaphragm in subsection (b), that other drain may be considered to be the diaphragm required by subsection (a).

(f) If the applicant desires to use any other type of seepage control, the applicant shall demonstrate to the chief engineer that the proposed type of seepage control protects the dam from seepage along the conduit and meets the requirements of sound engineering principles and commonly accepted engineering practices. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-55. Earthen auxiliary spillways. Each earthen auxiliary spillway shall meet all of the following requirements:

(a) If the design discharge from the auxiliary spillway is directed so that the discharge impinges on the downstream toe of the dam, a wing dike shall be designed and constructed to direct spillway flows away from the downstream toe of the dam.

(b) If the auxiliary spillway is located on the embankment of the dam, adequate armor protection, including articulated blocks, concrete paving, gabion baskets underlain with properly designed bedding, or engineered riprap, shall be placed on the portion of the dam where the auxiliary spillway is located.

(c) The side slopes shall be no steeper than three horizontal units to one vertical unit, unless the spillway is constructed through competent sandstone or limestone.

(d) There shall be at least a 30-foot level section immediately upstream of the control section. Immediately downstream of the control section, the slope of the spillway outlet shall be sufficient to ensure that flows at and above 50 percent of the design storm discharge will flow at a supercritical velocity.

(e) The auxiliary spillway shall be a minimum of three feet deep, as measured from the elevation of the control section to the design top of the dam.

(f) The entrance channel from the reservoir to the level section shall provide a smooth transition that prevents turbulent flow.

(g) The outlet channel shall convey flow to the receiving stream channel with a minimum of erosion.

(h) If a fish screen is installed, the screen shall not impair the functioning of the auxiliary spillway. If a fish screen is proposed, the design report shall demonstrate that the screen will not impair the functioning of the auxiliary spillway. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-56. Maximum design velocity for an auxiliary spillway.

(a) The maximum velocity in feet per second during the design storm for water flowing in a vegetated earthen auxiliary spillway shall be determined from the following table:

	Slope of the exit channel			
Vegetation	Erosion-resistant soils		Easily erodible soils	
	0% to 5%	5% to 10%	0% to 5%	5% to 10%
Bermuda grass and Bahia grass	8	7	6	5
buffalo grass,				

Kentucky blue grass, smooth brome grass, tall fescue, and reed canary grass	7	6	5	4
sod-forming grass-legume mixtures	5	4	4	3
weeping love grass, yellow bluestem, and native grass mixtures	3.5	3.5	2.5	2.5

(b) The maximum design velocities specified in subsection (a) may be increased by not more than 10 percent if the design frequency of use of the auxiliary spillway is not more than two percent. The maximum design velocities may be increased by not more than 25 percent if the design frequency of use of the auxiliary spillway is not more than one percent.

(c) For exit channel slopes greater than 10 percent, the applicant shall provide analyses showing both of the following:

(1) There is no more than 0.5 foot of erosion depth within 20 feet of the control section for the one-percent chance storm.

(2) The auxiliary spillway does not fail by breaching during the spillway stability design event indicated in the following table:

Hazard class	Size class	Spillway stability design event
A	1, 2, or 3	0.3 PMP
A	4	0.4 PMP
B	1, 2, 3, or 4	0.5 PMP
C	1, 2, 3, or 4	PMP

(d) The provisions of paragraphs (c)(1) and (2) may be used for slopes of 10 percent or less in lieu of the maximum values specified in the table in subsection (a).

(e) The maximum allowable design velocity for water flowing over the following types of materials shall be determined from the following table:

Material	Maximum velocity allowed in feet per second
stratified rock	8.0
sound rock	13.0

(f) Channel lining materials not reliant on vegetation, including concrete, riprap, and grouted riprap, may be used if the applicant demonstrates that the lining will not fail during the spillway stability design event specified in paragraph (c)(2). (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-57. Service spillway design.

(a) If a dam will have a service spillway, the spillway shall be designed and constructed with a lining material that meets the following requirements:

(1) Covers the channel floor and walls up to the depth of flow required to bypass the flows of the storm specified as the detention requirement in K.A.R. 5-40-23(a), at a minimum; and

(2) will not fail during the spillway stability design event specified in K.A.R. 5-40-56(c)(2).

(b) Each design report required by K.A.R. 5-40-2b shall include all hydraulic, structural, and geotechnical design information necessary to show that the criteria in subsection (a) are met.

(c) If a fish screen is installed, the screen shall not impair the functioning of the service spillway. If a fish screen is proposed, the design report shall demonstrate that the screen will not impair the functioning of the service spillway. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-70. Construction notification to the chief engineer. Each holder of a permit to construct, or an approval to repair or modify a dam, shall notify the chief engineer at least 48 hours before any of the following stages of construction and shall obtain the approval of the chief engineer before proceeding with each of these stages of construction:

(a) Starting construction;

(b) placing backfill in the cutoff trench;

(c) placing backfill around the primary spillway conduit or any other conduit that extends through the dam embankment and exits the downstream slope; and

(d) starting any stage of construction not specified in this regulation for which the permit requires that the chief engineer shall be notified. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301a and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-71. Inspection during dam construction, repair, and modification.

(a) Except as specified in subsection (d), each high-impact dam shall be inspected by an engineer competent in the design of dams, or that engineer's authorized representative, at all times during any construction activity.

(b) Each low-impact dam shall be inspected by an engineer qualified in the design of dams, or that engineer's authorized representative, whenever any of the following conditions is met:

(1) Backfill is being placed in the cutoff trench of a dam.

(2) Conduits and their appurtenances are being placed.

(3) Backfill is being placed around a conduit.

(4) Drain material and outlets are being installed.

(5) Concrete forms and reinforcing steel are being placed.

(6) Concrete is being placed.

(7) Any other stage of construction required by the permit, approved plans, or approved specifications to be inspected occurs.

(c) Before the start of construction, the permit holder shall provide the chief engineer in writing with the name, address, and telephone number of the engineer responsible for the inspection.

(d) The inspecting engineer, or the engineer's authorized representative, shall not be required to be present during any of the following construction activities for a high-impact dam:

(1) The clearing and grubbing of the construction site;

(2) the removal of structures from the reservoir area other than the removal of a dam;

(3) the installation of pollution-control measures, unless required by other authorities;

(4) seeding;

(5) mulching; and

(6) the construction of a fence.

(e) If the inspecting engineer, or the engineer's authorized representative, observes construction activity that is not in compliance with the approved permit, plans, or specifications and the contractor fails to correct the item or items that are not in compliance with the approved permit, plans, or specifications after being notified by the inspector, the inspector shall notify the chief engineer of the noncompliant activity. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301a and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-72. Construction inspection reports. The engineer responsible for the inspection required by K.A.R. 5-40-71 shall, within 30 days of the completion of the construction, repair, or modification of the dam and its appurtenances, submit to the chief engineer an inspection report containing the following items:

(a) A notice of completion showing the date on which construction, repair, or modification of the dam and its appurtenances was completed;

(b) a statement indicating one of the following:

(1) The dam and its appurtenances were constructed, repaired, or modified substantially in accordance with the permit and the approved plans and specifications; or

(2) the completed work varied from the permit and the approved plans and specifications. A description of each variation shall be provided;\

(c) a final survey of the completed dam and its appurtenances, including the following:

(1) A profile of the top of the dam;

(2) a profile of the centerline of the auxiliary spillway or service spillway;

(3) a cross section at the control section of the auxiliary spillway or service spillway;

(4) a cross section of the dam at its deepest point;

(5) a cross section of the dam at the primary spillway if that section is not near the deepest section of the dam;

(6) the locations and elevations of the inlet and the outlet of the primary spillway;

(7) the location and elevation of each drain outlet; and

(8) the final elevation and coordinates of each permanent benchmark; and

(d) a summary or a copy of the daily inspection logs if required by the permit. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301a and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-73. Emergency action plan.

(a) The owner of each hazard class B dam shall create an emergency action plan (EAP) on a form prescribed by the chief engineer. The owner shall keep the original EAP and submit a copy of the EAP to the chief engineer. The EAP shall address each of the following:

(1) A description of the dam, including the location of the dam and the access roads;

(2) the name, address, and telephone number of the person responsible for notifying local authorities of an emergency;

(3) a map or written description of the area that could be inundated by the type of breach described in K.A.R. 5-40-24;

(4) a list of persons who should be notified in case of an emergency, including the telephone numbers of those persons and their responsibilities; and

(5) the names, addresses, and telephone numbers of each owner of the dam and its appurtenances and those persons responsible for the operation and maintenance of the dam.

(b) Except as specified in subsection (d), the owner of a hazard class C dam shall create and maintain an emergency action plan that meets the recommendations of the "federal guidelines for dam safety: emergency action planning for dam owners," prepared by the interagency committee on dam safety and published by the federal emergency management agency, dated October 1998 and reprinted January 2004, which is hereby adopted by reference. The owner shall submit a copy of the EAP to the chief engineer.

(c) The owner of any dam for which an EAP is required under these regulations shall annually review the EAP to determine if it is still accurate and applicable to the current condition of the dam and current downstream conditions, including the following:

(1) The contact names and related information;

(2) the breach inundation map or a description of the inundation area; and

(3) emergency procedures.

If any material changes are made when updating the EAP, a copy of the revised EAP shall be submitted to the chief engineer.

(d) Any owner of a hazard class C dam may request that the chief engineer allow the owner to submit an EAP that meets only the requirements of subsection (a) in lieu of meeting the requirements of subsection (b). To make this request, the owner shall submit written justification of why an EAP meeting the requirements of subsection (a) is sufficient to protect the public safety. If the chief engineer approves the request, the chief engineer shall reserve the right to later impose the requirements of subsection (b) if downstream conditions change, the condition of the dam deteriorates, or the EAP does not adequately protect the public safety.

(e) The owner of a hazard class B dam shall submit the required EAP within 180 days of written notification by the chief engineer of the requirement.

(f) The owner of a hazard class C dam shall submit the required EAP within 180 days of written notification by the chief engineer that an EAP is required and that an adequate EAP is not on file in the chief engineer's office. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-73a. Discovery of an existing illegal, unpermitted dam.

(a) Except when it is necessary to take additional actions to protect the public safety, when the chief engineer becomes aware of an existing illegal, unpermitted dam, the following actions shall be taken by the chief engineer:

(1) Determine the hazard classification and condition of the dam;

(2) notify the owner of the dam of the following, in writing:

(A) The fact that the dam is illegal and unpermitted;

(B) the hazard classification of the dam;

(C) the fact that if the owner desires to keep the dam in existence, the owner shall submit a complete application for a permit for the dam pursuant to K.S.A. 82a-301 and K.S.A. 82a-302, and amendments thereto, within 120 days of the date of the chief engineer's notification;

(D) the condition that the application to obtain a permit for the dam shall meet the requirements of K.A.R. 5-40-8 and K.A.R. 5-40-74;

(E) the fact that failure to apply for a permit within 120 days shall result in the issuance of an order by the chief engineer requiring the owner to submit plans to breach or completely remove the dam; and

(F) the fact that the dam is subject to the provisions of this regulation.

(b)(1) If the owner submits an application for a permit within the time specified in paragraph (a)(2)(C), or within any extension of time authorized by the chief engineer in writing, the application shall meet the requirements of K.A.R. 5-40-8 and K.A.R. 5-40-74.

(2) If the owner fails to submit an application for a permit within the time specified in paragraph (a)(2)(C), or within any extension of time authorized by the chief engineer, an order requiring the owner to perform the following shall be issued by the chief engineer:

(A) Submit plans to breach or completely remove the dam; and

(B) bypass inflows and release water from storage so that no more than 15 acre-feet of water is kept in storage in the reservoir while the application for a permit to breach or completely remove the dam is being processed. The application for a permit shall contain all of the information required by K.A.R. 5-40-8 and any other information necessary to properly and safely design and complete the breach or removal. The application shall be submitted within 120 days of the date of the order, or within any extension of time authorized by the chief engineer. The owner shall be required to complete the breach or removal as permitted by the chief engineer within one year of the approval of a permit by the chief engineer, or any extension of time authorized by the chief engineer in writing.

(c) If the chief engineer dismisses an application for an existing illegal, unpermitted dam for any reason, the dismissal of the application shall be accompanied with an order requiring the dam to be breached or removed as provided in paragraph (b)(2).

(d) The order described in paragraph (b)(2) shall be filed by the chief engineer with the register of deeds for the county in which the dam is located.

(e) Each existing illegal, unpermitted dam of which the chief engineer becomes aware, either before or after the adoption of this regulation, shall be subject to this regulation. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301, 82a-302, and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-74. Design criteria for an existing illegal, unpermitted dam.

(a) Except as specified in subsection (b), the design criteria specified in this subsection (a) shall be met to obtain a permit from the chief engineer pursuant to K.S.A. 82a-301 et seq., and amendments thereto, for an existing illegal, unpermitted hazard class A dam constructed before May 1, 1984 that has not been modified on or after May 1, 1984. The applicant shall have an engineer who is qualified in dam design and construction conduct an inspection of the dam and prepare a report that includes all of the following:

(1) The date of the inspection and a list of the members of the inspection team;

(2) color photographs documenting the condition of the dam's appurtenances and embankment and any observed deficiencies in the appurtenances and embankment;

(3) a plan view sketch of the dam and its immediate vicinity showing the location from which each photograph was taken and the direction in which it was taken;

(4) a description of the physical condition of the dam and its appurtenances, a list of the deficiencies that were observed, and a description of the severity of each observed deficiency. All deficiencies that may threaten the structural integrity of the dam shall be shown; and

(5) a survey of the dam, documented by a plan view of the dam and cross section drawings, including the following:

(A) Cross sections of the embankment every 200 feet, with each cross section starting from the upstream toe of the dam or the water surface on the upstream side to the toe of the dam on the downstream side of the dam;

(B) a profile of each open-channel spillway from the water surface on the upstream side of the dam to the point where spillway flows enter the receiving stream;

(C) a cross section of each open-channel spillway every 200 feet and at each control section, with a minimum of two cross sections;

(D) the elevation of each primary spillway inlet and outlet;

(E) the elevation of the flow line of the outlet channel; and

(F) the dimensions, locations, and descriptions of materials, workmanship, condition, apparent purpose for, and any other relevant information about all visible appurtenances in sufficient detail to represent the appurtenances in three dimensions;

(6) the dimensions and location of each deficiency noted as required in paragraph (a)(4);

(7) the estimated rate and color of discharge from drain outlets and any seeps;

(8) a determination of the hazard classification of the dam as specified in K.A.R. 5-40-24;

(9)(A) A description of the drawdown valve, if any;

(B) specification of whether the valve was operated during the inspection; and

(C) if the valve could not be operated, an explanation of why it could not be operated;

(10) the name, mailing address, and telephone number of the engineer who conducted the inspection;

(11) the name, mailing address, and telephone number of each current owner of the dam; and

(12) any other information relevant to the safety and integrity of the dam, including any items requested by the chief engineer before the inspection.

(b) If the applicant provides construction plans prepared before construction that show how the dam was to be constructed or modified and that reflect the actual dimensions of the dam as it exists, those plans may be substituted for the survey required in paragraph (a)(5).

(c) If the chief engineer determines from the inspection report that the dam does not pose a threat to public safety or public or private property and that the condition of the dam is sound, an after-the-fact permit may be issued by the chief engineer pursuant to K.S.A. 82a-301 et seq., and amendments thereto.

(d)(1) In order for an existing illegal, unpermitted hazard class A dam constructed or modified on or after May 1, 1984 or an existing illegal, unpermitted hazard class B or C dam to receive a permit from the chief engineer pursuant to K.S.A. 82a-301 et seq. and amendments thereto, the applicant shall demonstrate that the dam meets all of the applicable statutory and regulatory requirements in effect when the application for the permit is filed. The applicant shall provide a survey meeting the requirements of paragraph (a)(5) and a design report that meets the requirements of K.A.R. 5-40-2b. If plans are available that show how the dam was constructed or modified and those plans reflect the actual dimensions of the dam as it exists when the application is filed, the plans may be substituted for the required survey. If a geologic investigation was conducted before construction of the dam and the results of that investigation are available, that investigation may be substituted for the investigation and report required by K.A.R. 5-40-40 through K.A.R. 5-40-42.

(2) If the applicant cannot determine that the chief engineer's requirements for the following design or actual construction properties were met without significantly disturbing the embankment but the applicant demonstrates that the dam was built in a manner appropriate to the standards in effect when the dam was constructed, then a permit may be issued if the chief engineer determines that the dam does not pose a hazard to public safety:

(A) The location, dimensions, and composition of the backfill materials to fill the cutoff trench;

(B) the location, dimensions, and construction of cutoff collars, drains, or other seepage control;

(C) the allowance for settlement of an earthen dam;

(D) specification of whether the primary spillway pipe was tested;

(E) the specifications used; and

(F) documentation of any construction inspections. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301a, 82a-302, and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-75. Maintenance of dams. Each owner of a dam that the chief engineer has authority to regulate pursuant to K.S.A. 82a-301 et seq., and amendments thereto, shall operate and maintain the dam in a manner that protects the public safety, complies with the terms of any permit of the chief engineer, and ensures the integrity of the dam. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301a and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-76. Repair or modification of a permitted or prejurisdictional dam.

(a) The repair or modification of a permitted or prejurisdictional dam shall meet the requirements of both of the following:

(1) The statutes and the regulations in effect when the application for repair or modification is filed; and

(2) any additional criteria specified by the chief engineer that are necessary to ensure the integrity of the dam and its appurtenances.

(b) At the time of the repair or modification, the applicant shall bring the dam and all of its appurtenances into conformance with the requirements of the statutes and regulations in effect at the time of the application for repair or modification, unless both of the following conditions are met:

(1) The applicant demonstrates that bringing any feature of the dam and its appurtenances into compliance is not feasible or is unduly burdensome.

(2) The chief engineer determines that failing to bring any feature of the dam into compliance with one or more requirements applicable to that feature will not significantly affect the public safety.

(c) Each application to repair or modify a dam or its appurtenances shall include a design report on the repair or modification, including a section describing the condition of the dam at the time of the application. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-77. Easements for dams.

(a) Each applicant that applies for a permit to construct a dam, modify a dam in a manner that will raise the top of the dam, or modify the dam in any other way that will increase the backwater effect of the dam or the flow of water from the dam to the receiving stream shall demonstrate either of the following to the chief engineer:

(1) The applicant owns the site of the dam and appurtenant works, the land that will be inundated, and the land over which discharge from the dam's spillways will flow.

(2) The applicant has easements or other legal authority to perform the following for the design life of the dam:

(A) Construct and maintain the dam;

(B) inundate all of the land upstream from the dam to the top of the dam elevation; and

(C) discharge water from the spillways to a stream channel and the associated floodplain adequate to convey the discharge from the design storm.

(b) For permitted dams for which a modification is proposed, an easement or other legal authority shall be required only for the effects caused by the modification. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302, K.S.A. 82a-303, and K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-90. Requirements for a dam safety inspection report. Each dam safety inspection report required by K.S.A. 82a-303b, and amendments thereto, shall document the observations made during the inspection and the engineer's opinion of the condition of the dam and shall include all of the following:

(a) An executive summary briefly describing the overall condition of the dam as found during the inspection;

(b) the date of the inspection and a list of the members of the inspection team;

(c) color photographs documenting the condition of the dam appurtenances and embankment and any observed deficiencies in the appurtenances and embankment;

(d) a plan view sketch of the dam and the vicinity, showing the location where each photograph was taken and the direction in which the photograph was taken;

(e) a description of the physical condition of the dam and its appurtenances, a list of any deficiencies that were observed, and a plan view sketch of the dam and its appurtenances showing the location of those deficiencies. The deficiencies that shall be shown shall include those that meet any of the following conditions:

(1) Violate the permit or approved plans or any approved modifications of the permit or approved plans;

(2) threaten the structural integrity of the dam; or

(3) threaten the safety of people or property above or below the dam;

(f) survey and other documenting data if the engineer observes any changes from previously documented conditions in the dam or its appurtenances that could jeopardize the integrity of the dam, including any changes in the profile or cross section of the dam, profile, or cross section of any open-channel spillway, and areas of settlement or erosion;

(g) a description of the severity of each observed deficiency and the engineer's opinion about the urgency of remedying each deficiency;

(h) a summary of the engineer's review of the adequacy of the emergency action plan, including a review of any updates since the last inspection;

(i) the estimated rate and color of discharge from drain outlets and any seeps;

(j) a statement indicating whether the engineer agrees or disagrees with the hazard classification of the dam, including the reasons why the engineer agrees or disagrees with that classification;

(k) a map drawn to a scale of 1:24,000 or larger showing the location of any hazards added, removed, or not previously shown downstream of the dam, in addition to those identified in previous reports, that would require a modification of the emergency action plan or might change the hazard classification of the dam;

(l) any significant changes in the capacity of the reservoir;

(m) any significant changes in the capacity of any spillway;

(n) a statement indicating whether there have been any significant changes in the watershed and an estimate of the impact of those changes on the design hydrology;

(o) the name, mailing address, and telephone number of the engineer;

(p) the name, mailing address, and telephone number of each current owner of the dam;

(q) observations or readings from all instrumentation required by the permit, the approved plans, the approved specifications, or the chief engineer;

(r)(1) A description of the drawdown valve, if any; and

(2) specification of whether the drawdown valve was operated during the inspection and, if the valve could not be operated, an explanation of why it could not be operated; and

(s) any other information relevant to the safety of the dam, including any items requested by the chief engineer before the inspection. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-91. Schedule for inspection of hazard class C dams. Each hazard class C dam shall be inspected every third inspection year after the inspection year in which the initial inspection was completed. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-92. Schedule for inspection of hazard class B dams. Each hazard class B dam shall be inspected every fifth inspection year after its initial inspection. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-93. Schedule for inspection of dams. The initial and follow-up dam safety inspections required by K.S.A. 82a-303b, and amendments thereto, for any dam completed on or after July 1, 2002, shall be conducted and a report shall be filed with the chief engineer in accordance with the following schedule:

(a) Each permitted hazard class C dam shall be inspected in the third inspection year after the inspection year in which the dam is completed and every third inspection year thereafter.

(b) Each permitted hazard class B dam shall be inspected in the fifth inspection year after the inspection year in which the dam is completed and every fifth inspection year thereafter.

(c) Each unpermitted class B or class C hazard dam completed on or after July 1, 2002, shall be inspected in accordance with a schedule approved by the chief engineer as necessary to protect the public safety.

(d) Each dam that had its hazard class increased by the chief engineer on or after July 1, 2002, shall initially be inspected by the chief engineer in the inspection year in which the hazard class is increased.

(e) If the dam was reclassified as a hazard class B dam, the dam shall be inspected every fifth inspection year after the inspection year in which the hazard class was changed.

(f) If the dam was reclassified as a hazard C dam, the dam shall be inspected every third inspection year after the inspection year in which the hazard class was changed. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-94. Revision of schedule of inspections. For good cause shown, including a change in hazard class or repair or modification of a dam, the dam safety inspection schedule may be revised by the chief engineer and a new inspection cycle may be started. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-303a and 82a-303b; effective May 18, 2007.)

K.A.R. 5-40-100. Request to be included on the list of independent engineers qualified to review applications.

(a) Each licensed professional engineer who desires to be placed on the list of licensed professional engineers approved to review applications for the permit required by K.S.A. 82a-301 et seq., and amendments thereto, shall submit a request to the chief engineer on a form prescribed by the chief engineer.

(b) Any engineer may request approval in one or more of the following areas:
(1) Dam design;
(2) channel design; and
(3) the design of stream obstructions other than dams.

(c) A team of persons may be qualified to be a reviewer for a project. The qualifications of each team member shall be submitted, and one person shall be designated as the supervising reviewer. The supervising reviewer shall meet the minimum requirements for an individual reviewer. The other members of the review team shall not be required to meet the minimum requirements for an individual reviewer. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-101. Information to be submitted with a request to be a reviewer.

(a) Each engineer who wants to be included on the list of licensed professional engineers approved to review applications under the obstructions in streams act, as authorized by K.S.A. 82a-302, and amendments thereto, shall submit that request on a form prescribed by the chief engineer and shall designate each area of review for which the engineer or a team of engineers desires to be approved.

(b) All of the following information shall be included on each request for each area in which the engineer seeks to be approved:

(1) The type and license number of each current license from the Kansas state board of technical professions;

(2) relevant education, including graduate and postgraduate schools attended, degrees received, and professional development work; and

(3) work experience in the requested area of expertise, including the following:

(A) The number of years of experience as an engineering intern;

(B) the number of years of experience as an engineer; and

(C) the approximate number of projects for which the engineer met the following criteria:

(i) Was responsible for the project;

(ii) performed substantive design tasks;

(iii) had quality assurance, quality control, or project review responsibilities; and

(iv) performed construction supervision or inspection; and

(D) the project name, the location, a brief description of the project, and a brief description of the engineer's responsibilities for one or two projects for which the engineer met the following criteria:

(i) Had responsible charge or performed significant portions of the design; or

(ii) provided quality control, quality assurance, project review, construction supervision, or construction inspection duties. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-102. Minimum requirements to be an individual reviewer. To be an individual reviewer, each person shall meet both of the following qualifications:

(a) Have a current professional engineer's license from the Kansas state board of technical professions; and

(b) have a minimum of five years of relevant work experience in the area for which approval is sought. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-103. Conflict of interest. A reviewer shall not be eligible to review any of the following:

(a) Any project in which the reviewer has participated in the project's design in any way;

(b) any project designed by any other employee of the reviewer's current employer; or

(c) any other project for which the reviewer has a conflict of interest with the owner of the dam, the designer of the dam, or the state of Kansas. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-104. Notification of approval or disapproval to be a reviewer. Within 60 days of the receipt in the office of the chief engineer of a completed request pursuant to K.A.R. 5-40-101, the requester shall be notified by the chief engineer of whether that individual has been approved in each requested area. If the chief engineer has not approved the request for each area of review requested, the requester shall be notified by the chief engineer of the reason or reasons that each request has been denied. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-105. Procedure for independent review of an application to construct a dam or other water obstruction.

(a) When an applicant provides a copy of that individual's application to an approved reviewer pursuant to K.S.A. 82a-302 and amendments thereto, the applicant shall also submit the following to the chief engineer:

(1) The original application;

(2) all documentation required for an acceptable application as specified in K.A.R. 5-40-8;

(3) the statutorily required filing fee; and

(4) the name, address, and telephone number of the reviewer.

(b) The review required by the water projects environmental coordination act, K.S.A. 82a-325 et seq. and amendments thereto, shall be initiated by the chief engineer after the chief engineer receives the application.

(c) Within 37 days after the review specified in subsection (b) is initiated by the chief engineer, any comments received from the environmental review agencies shall be sent by the chief engineer to the reviewer. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-40-106. Report of findings of independent reviewer.

(a) When a reviewer completes the review of an application pursuant to K.S.A. 82a-302 and amendments thereto, the reviewer shall submit a report of that review to the chief engineer. The report shall be properly sealed by the reviewing engineer as directed by the Kansas state board of technical professions.

(b) Each complete report shall include the following:

(1) An opinion as to whether the application meets the requirements of K.S.A. 82a-301 et seq., and amendments thereto, the regulations that implement these statutes, sound engineering principles, and commonly accepted engineering practices;

(2) the basis for that opinion, including any analyses that were performed, and the supporting data;

(3) an evaluation of the comments from the environmental review agencies that were furnished to the reviewer by the chief engineer and a recommendation about how to address all adverse comments;

(4) a recommendation about whether any request by the applicant to waive one or more regulations should be approved and the basis for approving or denying the waiver; and

(5) a recommendation about whether the chief engineer should approve or deny the permit and any conditions that the chief engineer should impose on the permit.

(c) The recommendations shall not be binding on the chief engineer. The chief engineer shall maintain the final authority to approve or deny all applications. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-302 and 82a-303a; effective May 18, 2007.)

K.A.R. 5-41-1. Channel changes; plans and specifications. Plans for a channel change shall include the following:

(a) A general location map or aerial photograph, showing the present alignment of the stream, location of the proposed channel change, section lines, property lines with names and addresses of adjoining landowners, drainage area, a north arrow, a bar scale, and any other prominent features;

(b) a detailed plan view of the project with stationing shown, including as many other views as necessary to fully describe the project;

(c) a profile drawing along the centerline of the proposed new channel. This profile shall extend five times the channel width upstream and an equivalent distance downstream from each end of the new channel. The stationing shown on the plan view shall correspond to stationing on the profile drawing. This drawing shall show the present ground surface, the present stream bed, and the grade line of the proposed new channel;

(d) cross sections of the existing stream at locations immediately above and below the proposed channel change. The location of these cross sections shall be described and shown on the plans. The elevations of the top of the existing banks and bottom of the channel shall be shown;

(e) at least one permanent bench mark conveniently located for use after construction, except for grassed waterways constructed for the purpose of conveying runoff without causing erosion or flooding. The location, description, and elevation of the permanent bench mark, to which all elevations are referred, shall be shown on the plans. The designer shall reference the project bench mark to the current national geodetic vertical datum, to a tolerance of plus or minus ½ foot on all channel changes involving perennial streams and where detailed floodplain data are available. Project datum shall be acceptable on all other channel changes; and

(f) a cross-sectional drawing of the proposed new channel, including dimensions. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1987; amended Sept. 22, 2000.)

5-41-2. Channel changes; water velocity. The new channel shall have a conveyance capacity equal to or greater than the old channel. The water velocity after the completion of the proposed channel change or stream obstruction shall not exceed a permissive velocity. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

5-41-3. Channel changes; side slopes. The side slopes of the proposed new channel shall not be steeper than one foot vertical to two feet horizontal unless the applicant submits data and analysis to show that a steeper slope will be stable. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

5-41-4. Channel changes; construction by erosion. New channels shall not be constructed by erosion. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

5-41-5. Channel changes; disposal of excavated material.

(a) Material removed from the newly excavated channel shall be deposited at a location and in a form acceptable to the chief engineer. If the material is to be deposited so that it will have the effect of a levee, a separate prior written approval of the chief engineer is required pursuant to K.S.A. 24-126.

(b) Filling or plugging the original channel shall receive the prior written approval of the chief engineer. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

K.A.R. 5-41-6. Channel changes; vegetative strips on new channels. On each new channel project, except a grassed waterway constructed for the purpose of conveying runoff without causing erosion or flooding, a vegetative strip shall be established and maintained for a width of 50 feet immediately adjoining the channel on each side of the stream if site conditions permit, or unless an acceptable engineering design shows that a greater or lesser width of vegetative strip is preferable. The general type of vegetation shall be approved by the chief engineer. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987; amended Sept. 22, 2000.)

K.A.R. 5-42-1. Stream obstructions; plans and specifications.

(a) The plans required for a permit for a stream obstruction pursuant to K.S.A. 82a-301, and amendments thereto, shall include the following:

(1) A general location map or aerial photograph showing the stream, location of the proposed obstruction, sufficient detail to locate the proposed construction site, section lines, a bar scale, a north arrow, property lines with the names and addresses of adjoining

landowners, and any other landowners whose land may be hydraulically affected by the proposed stream obstruction, drainage area, and any other prominent features;

(2) a detailed plan view fully describing the obstruction and the site;

(3) the following topographical information, which shall be provided from streambed elevation to the limits specified in subsection (b):

(A) A profile of the streambed and both banks;

(B) a contour map with a contour interval of no more than two feet; or

(C) cross sections perpendicular to the stream and at intervals of no more than five times the width of the channel;

(4) an elevation view showing the obstruction on a cross section of the stream and the valley up to the post project design flood elevation at the site;

(5) at least one permanent benchmark shall be conveniently located for use after construction. The location, description, and elevation of the permanent benchmark, to which all elevations are referred, shall be shown on the plans. Reference to the national geodetic vertical datum of 1988, or other acceptable national vertical datum, to a tolerance of plus or minus one-half foot shall be required for all stream obstructions on perennial streams and all other streams where base flood elevations have been determined and are shown on flood insurance rate maps. An assumed project datum shall be acceptable on all other stream obstruction projects;

(6) details of the manner in which the obstruction is to be tied into the bed and banks of the streams;

(7) the land for which easements or rights-of-way are to be acquired if the proposed obstruction affects land other than that owned by the applicant; and

(8) unless it is clear that the impact of the proposed project will be contained within the channel or limited to property under the control of the applicant, a hydraulic analysis determining the preproject and postproject water surface elevations for the 50 percent-chance flood and the one percent-chance flood shall be prepared and submitted to the chief engineer.

(b)(1) If it is clear that the impact of the proposed stream obstruction will be contained within the channel or limited to property under the control of the applicant, the topographical information upstream of the stream obstruction required in paragraph (a)(3) shall be required to either of the following, whichever is lower:

(A) The elevation of the highest point on the proposed obstruction; or

(B) the elevation of the one percent-chance flood water surface.

The applicant shall not be required to show topographical information for any property not under the control of the applicant.

(2) If it is not clear that the impact of the proposed project will be contained within the channel or limited to property under the control of the applicant, the topographical information upstream of the stream obstruction required in paragraph (a)(3) shall be provided from streambed elevation up to the elevation of the one percent-chance flood water surface upstream of the stream obstruction.

(3) The topographical information required in paragraph (a)(3) and subsection (b) shall be provided downstream of each proposed stream obstruction for a distance equal to five times the width of the channel at the proposed site of the stream obstruction or 50 feet downstream from the toe of the stream obstruction, whichever is greater.

(c) Each application for a permit to construct a stream obstruction shall include the following specifications:

(1) Each major element in the construction of the obstruction;

(2) the minimum quality of workmanship that is acceptable to construct the obstruction;

(3) the minimum quality of materials that is acceptable to construct the obstruction; and

(4) the materials proposed to be used to construct the obstruction.

(d) The specifications shall meet the following requirements:

(1) Be clear, legible, and shown in sufficient detail to assure that the work can be properly constructed; and

(2) be shown on the plans, in the design report, or on a separate document.

(e) If the Kansas department of transportation (KDOT) standard construction specifications meet all of the requirements of this regulation and are to be enforced during construction, referencing those specifications on the plans shall be sufficient to comply with this regulation.

(f) If the standard construction specifications of a city or county in Kansas meet the following requirements, then referencing those specifications on the plans shall be sufficient to comply with this regulation:

(1) Meet all the requirements of this regulation;

(2) are to be enforced during construction; and

(3)(A) Have been provided to the chief engineer; or

(B) are readily available at no cost from the city or county that utilizes the specifications. (Authorized by K.S.A. 2006 Supp. 82a-303a; implementing K.S.A. 2006 Supp. 82a-301, 82a-302, and 82a-303a; effective May 1, 1987; amended, T-5-12-30-91, Dec. 30, 1991; amended April 27, 1992; amended May 18, 2007.)

5-42-2. Stream obstruction; minor. If a proposed stream obstruction will not decrease the cross sectional area of a stream channel at the location of the obstruction by more than 15 percent, the plans required by the chief engineer shall be equivalent to the type submitted to the United States corps of engineers with applications for a department of the army permit. Such obstructions shall include weirs, causeways, low-water crossings, low-head dams, intake structures, boat launching ramps, pipeline crossings, outfall structures, marinas, boat docks, jetties and revetments. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

K.A.R. 5-42-3. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987; amended April 27, 1992; revoked Sept. 22, 2000.)

K.A.R. 5-42-4. Stream obstruction; temporary structure. A temporary structure shall not require a stream obstruction permit from the chief engineer pursuant to K.S.A. 82a-301 et seq. and amendments thereto if it meets all of the following criteria:

(a) The structure is temporary in nature.

(b) The structure is constructed only of temporary materials, including local streambed materials, straw or hay bales, plastic, or plywood, that are likely to wash out during a bank-full storm event.

(c) The structure is actively maintained only during the duration of the temporary beneficial use.

(d) The structure is less than two feet in height above the natural bed of the stream, and alterations to the stream and alterations to the stream bank are no more than are necessary for permitting access to the site for operation and maintenance.

(e) The structure is below the natural low bank of the stream.

(f) Any water backed up by the structure is detained solely on property under the control of the landowner that constructed the temporary structure.

(g) The structure does not materially adversely affect the public interest, public safety, or environment. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective Sept. 22, 2000.)

K.A.R. 5-42-5. Determining the peak discharge of a one percent-chance storm. In determining the flow magnitude of a design storm, the applicant shall use one of the following methods.

(a) For drainage areas of less than 640 acres, use of the rational formula shall be acceptable.

The rational formula is $Q = CIA$

Where C = the runoff coefficient

I = the intensity of rainfall, in inches per hour

A = the drainage area, in acres.

(b) For any drainage area, the flow magnitude of a design storm may be determined by using one of the methods in the following:

(1) "Estimation of peak streamflows for unregulated rural streams in Kansas," water-resources investigations report 00-4079, published by the United States geological survey in 2000, which is hereby adopted by reference;

(2) "urban hydrology for small watersheds," technical release 55, published by the natural resources conservation service and dated June 1986, which is hereby adopted by reference; and

(3) "computer program for project formulation," technical release 20, published by the natural resources conservation service, United States department of agriculture, and dated October 2004, which is hereby adopted by reference.

(c) For streams for which sufficient stream gaging data is available, the applicant may use sound engineering principles and commonly accepted engineering practices to estimate the peak one percent-chance discharge from the gage record.

(d) A method other than the methods specified in subsections (a), (b), and (c) may be used to determine the one percent-chance storm discharge if the method meets both of the following criteria:

(1) The method is based on sound engineering principles and commonly accepted engineering practices.

(2) The method has been previously approved, in writing, by the chief engineer. (Authorized by and implementing K.S.A. 2006 Supp. 82a-303a; effective May 18, 2007.)

5-43-1. Sand dredging operation; plans and specifications. Plans for a sand dredging operation from a stream shall include:

(a) A general location map or aerial photograph showing the stream, location of the proposed sand dredging operation, section lines, property lines with names and addresses of adjoining landowners, local access roads, a bar scale, a north arrow and any other prominent features;

(b) a plat of the area within which the sand plant will be operated, prepared to a scale of 200 feet per inch, or less, if necessary to show in detail the features of the stream at the location. The plat shall include at least one permanent bench mark. The survey shall also include at least two permanent horizontal control points on a baseline running generally parallel to the stream. These permanent points shall be identified with substantial markers and shall be easily visible in the field. The plat shall show the location of the natural banks on both sides of the stream, all islands, sand bars, and the direction of the stream within the channel. Where county commissioners have established bank lines along a stream in accordance with the provisions of K.S.A. 82a-307a, the location of such established bank lines shall be shown. The plat shall also show the proposed location of the tipple, boundaries of areas from which material will be removed and the area to which rejected material will be returned;

(c) cross sections of the channel, measured along lines at right angles to the general direction of the stream and plotted to a horizontal scale of not more than 200 feet per inch and an appropriate vertical scale. Typical cross sections shall be shown for unobstructed portions of the channel as well as for portions in which islands, sand bars or other obstructions may be located. The elevation of the top of both banks, the bed of the stream, and the surface of islands and bars shall be shown on the cross sections. The location of lines along which cross sections are measured shall be referred to the baseline and indicated on the plat. All elevations shall be referred to a permanent bench mark,

which is referenced to the national geodetic vertical datum of 1929 to a tolerance of plus or minus one half foot; and

(d) a statement of plan of operation. A brief paragraph shall be included explaining the plants usual operating plans. The kind of equipment, pumping capacities, seasonal limitations and any other operational constrictions shall be included. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1987.)

5-43-2. Sand dredging; buffer zone. There shall be a buffer zone of not less than 500 feet between dredging operations, and between dredging operations and all bridges. There shall be a buffer zone of 300 feet between dredging operations and buried pipeline or cable crossings. There shall be a buffer zone of 200 feet between dredging operations and levees, or other features subject to damage by undercutting. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

5-43-3. Sand dredging; operation. In counties at locations where bank lines have been established on designated streams pursuant to K.S.A. 82a-307, materials shall be removed only between established bank lines. The chief engineer, for good cause, may allow excavation or removal of material landward from established bank lines if approval is also obtained from the board of county commissioners. On navigable streams materials shall be removed only from the channel and in such a manner so as not to degrade the banks. On all other streams, materials shall be removed only from areas and in a manner approved by the chief engineer. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

5-43-4. Sand dredging; operations conflicting. If more than one operator proposes to operate within a given reach of a private stream, then all conflicting applicants shall be required to submit proof of easements or other legal authority to operate. If more than one operator proposes to operate within a given reach of a navigable stream, the chief engineer shall determine which operators shall be permitted, based on the following criteria:

(a) The capability of the applicant's equipment to operate within the desired area;

(b) the applicant's need for the material;

(c) the applicant's existing operation, if any;

(d) the anticipated date the applicant will begin operation;

(e) the applicant's history of operation;

(f) the anticipated plant completion date;

(g) proof of the applicant's easements and right-of-ways necessary to operate;

(h) date of application; and

(i) any other relevant factor. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-302; effective May 1, 1987.)

5-43-5. Sand dredging; operation setback. Sand dredging operations located outside the channel of a stream shall be set back a minimum of 50 feet from the bank of the channel. There shall be a minimum slope on the sand plant side of not greater than one foot vertical to four feet horizontal. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective May 1, 1987.)

K.A.R. 5-46-1. General permits; bridge and culvert replacement projects.

(a) Except as provided in subsection (e), the construction of any bridge or culvert replacement project with a watershed of 2,560 or more acres in zone one, 3,840 or more acres in zone two, and 5,120 or more acres in zone three shall meet the criteria in subsection (c) of this regulation. Before construction, the applicant shall apply for and obtain a general permit from the chief engineer. The application shall be filed on a form prescribed by the chief engineer and shall be accompanied by plans or sketches meeting the requirements of K.A.R. 5-42-2.

(b) Except as provided in subsection (e), the construction of any bridge or culvert replacement project with a watershed of fewer than 2,560 acres in zone one, 3,840 acres in zone two, and 5,120 acres in zone three shall meet the criteria in subsection (c) of this regulation. Before construction, the applicant shall properly complete an application for, and receive the consent of, the chief engineer. The application shall be filed on a form prescribed by the chief engineer.

(c) Each bridge replacement and culvert replacement project shall meet all of the following criteria:

(1) The project shall not be a change either in alignment or in the cross section of a stream of more than 200 feet in length on minor streams, and not more than 400 feet in length on moderate or major streams as measured along the original channel. A minor stream is defined as a stream or watercourse that has a mean annual flow of less than five cubic feet per second (cfs). The major streams are the Kansas River, the Arkansas River, and the Missouri River. A moderate stream is defined as a stream or watercourse with a mean annual flow equal to or greater than five cfs, but is not a major stream.

(2) The proposed culvert or bridge replacement shall have the following:

(A) A cross-sectional area at least equivalent to that of the original bridge or culvert for water to flow over, through or around; and

(B) a road grade across the floodplain and approaching the bridge or culvert that is not raised by more than an average of one foot. The average rise of the road grade shall be calculated by measuring the difference between the proposed grade and the existing grade at the beginning and end of each interval of 100 or fewer feet, dividing the sum of the two differences by two and multiplying the mean by the number of feet in the interval. The sum of these calculations from each interval shall then be added together and the total sum divided by the length, in feet, of the road alteration. The average road

grade shall not increase by a cumulative amount of more than one foot since April 11, 1978.

(3) A vegetative strip measuring 50 feet from the bank and outward on each side of a channel change shall be maintained in a manner consistent with the existing riparian vegetation and other design criteria.

(4) The project shall not alter the channel's cross-sectional area by more than 15 percent, nor shall it alter the channel length by more than 10 percent.

(d) If any bridge or culvert replacement project does not meet the requirements of this regulation, the applicant may apply for a nongeneral permit pursuant to K.S.A. 82a-301 et seq., and amendment thereto, before construction.

(e) If any bridge or culvert replacement project does not meet the requirements of this regulation or the chief engineer determines that the project may have an unreasonable effect on the public interest, public safety, or environmental interests, the right to perform the following shall be reserved by the chief engineer:

(1) Require a general permit meeting the requirements of this regulation or a nongeneral permit meeting the requirements of K.S.A. 82a-301 et seq., and amendment thereto, before construction; and

(2) amend, modify, or revoke the prior general permit or consent issued in accordance with this regulation. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective Sept. 22, 2000.)

K.A.R. 5-46-3. General permits; sand and gravel removal operations.

(a) Before the commencement or continuation of any sand or gravel removal from a site with a drainage area of 50 or more square miles above the site, the removal operation shall meet the criteria in subsection (c) of this regulation. Before the removal of any sand and gravel, the owner shall apply for and obtain a general permit from the chief engineer. The application shall be filed on a form prescribed by the chief engineer and shall be accompanied by plans meeting the requirements of K.A.R. 5-42-2.

(b) If the proposed sand or gravel removal operation meets the criteria set forth in subsection (c) of this regulation and there are fewer than 50 square miles of drainage area above the proposed sand or gravel removal site, a permit shall not be required unless the chief engineer determines that a permit is necessary to protect the public interest, public safety, or environmental interests.

(c) All sand and gravel operations covered by this regulation shall meet the following criteria:

(1) The sand and gravel removal operation shall be limited to removing a maximum of 100 cubic yards per year from each sand and gravel removal site. Other than bridge maintenance sites, all sand and gravel removal operations on the same stream and its tributaries shall be separated by at least 1,320 feet.

(2) A sand and gravel removal operation shall not be located within the following distances of a bridge, pipeline, cable crossing, levee, or other feature, except when the

written permission or easement of the owner of the bridge, pipeline, cable crossing, levee, or other feature is obtained by the applicant, and a written waiver is granted by the chief engineer:

(A) 50 feet of the banks, or in the channels of the Missouri, Kansas, or Arkansas rivers, and 50 feet of the banks, or in the channels of their tributaries, for ½ mile upstream from the mouth of the tributaries;

(B) one mile of a public water supply intake;

(C) 500 feet of a bridge;

(D) 300 feet of a buried pipeline or cable crossing; and

(E) 200 feet of a levee or other feature subject to damage.

(3) Stockpiles of material shall be located in a manner that does not affect the flow of water on the property of any other landowner.

(d) If any sand or gravel removal operation covered by this regulation does not meet the requirements of this regulation, or if the chief engineer determines that the operation may have an unreasonable effect on the public interest, public safety, or environmental interests, the right to perform the following shall be reserved by the chief engineer:

(1) Require a nongeneral permit pursuant to K.S.A. 82a-301 et seq., and amendments thereto;

(2) amend, modify, or revoke the general permit issued in accordance with this regulation. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective Sept. 22, 2000.)

K.A.R. 5-46-4. General permits; pipeline crossings.

(a) Before the construction of any pipeline or buried cable crossing of a stream having 50 or more square miles of drainage area above the proposed project site, the project shall meet the requirements of subsection (c) of this regulation. Before construction, the owner shall apply for and obtain a general permit from the chief engineer. The application shall be filed on a form prescribed by the chief engineer.

(b) Any pipeline or buried cable crossings of streams that have fewer than 50 square miles of drainage area above the proposed project site and that meet the requirements of subsection (c) of this regulation shall not be required to have a permit pursuant to K.S.A. 82a-301 et seq., and amendments thereto.

(c) All pipeline or buried cable crossings covered by this regulation shall meet the following requirements:

(1) Underground pipelines and cables shall be buried at a depth below the stream bed sufficient to prevent exposure. For navigable streams, underground pipelines and cables shall be buried at a minimum depth of seven feet beneath the stream bed. For all other streams, underground pipelines and cables shall be buried at a minimum depth of five feet beneath the stream bed. Pipelines and cables shall be buried sufficiently into the banks to allow for a moderate amount of stream meander without exposure. The

minimum depth may be waived if the owner or applicant demonstrates that the underground pipeline or cable is adequately protected against erosion.

(2) After installation, the channel and banks shall be restored to the natural elevations and configurations as nearly as possible. Armoring devices shall be installed when necessary to ensure bank stability. Surplus excavated material shall be disposed of in a manner that will not obstruct the channel or act as a levee.

(d) If any pipeline or buried cable crossing covered by this regulation does not meet the requirements of this regulation, or if the chief engineer determines that a pipeline or cable crossing may have an unreasonable effect on the public interest, public safety, or environmental interests, the right to perform the following shall be reserved by the chief engineer:

(1) Require a nongeneral permit pursuant to K.S.A. 82a-301 et seq., and amendments thereto; and

(2) amend, modify, or revoke the general permit issued in accordance with this regulation. (Authorized by K.S.A. 82a-303a; implementing K.S.A. 82a-303; effective Sept. 22, 2000.)